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Safety-Valve Practice.

BY F. F. HEMENWAY.

If we were to judge by the diversity of practice in regard to the capacity of safety valves as applied to ordinary stationary boilers, in locations where there is no restraining law, it would seem that there must be much difference in opinion as to what this important adjunct of a steam boiler is really for. And the disagreement of "eminent authority" on this matter is rather worse than the difference in practice. It should be beyond any need of argument that the function of a safety valve is to prevent the accumulation of pressure in the boiler until the point of danger from explosion or over-straining is reached. As too often applied, it serves but little other purpose than to warn the attendant, if he happens to be within warning distance, that the fire should be checked, pump put working harder, or some assistance be given the valve to free the boiler of surplus steam, which the valve should assuredly do unaided. While to prevent, with certainty, any danger of explosion from over-pressure, is the prime duty of a safety valve, when we find its capacity for doing this, as given by one authority, four times as great as that given by another, it seems a reasonable conclusion that there must be a difference in opinion as to what a safety valve should do. Either this or that some slight variation in construction brings about a difference in action that, in its extent, is quite incomprehensible by average intelligence. Reference is had here to the ordinary safety valve of commerce, or, as is quite generally the case in boilers of considerable size, to those made for the occasion. Such valves are not commonly made with any great degree of refinement, it is true, but one is not likely to be very much worse than another.

As an example of what a safety valve may be called upon to do, I recollect an instance in the early days of the familiarly designated "pop" valve. I was commissioned by the inventor to look after the equipment of a locomotive with a pair of them for trial. The locomotive was a large one for the day, used for hauling freight 20 miles or so on a heavy grade. It was considered that in all respects the engine would do better with 20 pounds higher steam than the old valves began blowing at. The master mechanic was skeptical as to the ability of the new valves to hold the pressure at, practically, the 20 pounds increase, and before their application rather insisted that I should make the trip up the hill to see what the old valves would *not* do. I had previously made this same trip with the inventor, and for the same purpose, but the master mechanic was not then present. The engine was steaming at her best—and that was good—when the top of the hill was reached; then, at the request of the master mechanic, steam was shut off. Despite the protest of the old valves, the pressure increased 20 pounds in so short a space of time, and under such vigorous protest, as to make the ability of the new valves to do what was guaranteed for them look almost doubtful. How far this increase of pressure would have gone on, but for the interference of the engineer, I do not know.

As has been intimated, it is a rather notorious fact that the ordinary safety valve, as used on the boilers of stationary engines, is made with rather ample disregard for precision. It is useless to waste time discussing its shortcomings in this respect. The valves will undoubtedly continue to be made about as they have been made, notwithstanding it has been shown, repeatedly, that they can be made to behave much better than they do behave. They must be taken, and reasoned from, about as they are found. One of the strong points in favor of the various "pop" valves brought out during the past thirty years, is that they must be well made and mounted, or they will not operate with any degree of satisfaction, which is a good deal more in their favor than would appear at first sight.

What little I am able to say of the common lever safety valve, comes up through observation of what it does, and not from calculations of what it ought to do. That observation leads to the belief that the extreme limit as to size should be 3½ inches diameter. When the proper opening cannot be had with this diameter, then two valves should be employed. The reason for this is that a large valve never behaves as satisfactorily as a smaller one. For example, a 5-inch valve has more than twice the area of one 3½ inches diameter, but for the ordinary purposes of a safety valve will lack very much of passing twice as much steam. This, I believe, is not only a matter of observation of everyone who has given the matter much attention, but it is a matter of record as well. This is not only true of the ordinary valve, but is, in a measure, equally true of any "pop" valve, so far as I have had opportunity to observe. Why this should be true of the ordinary lever valve is too plain to require consideration. Why it should be true of the "pop" valve, if I am right in assuming that it is true, is by no means so evident.

It is not an entirely simple matter to fix upon the proper size of a safety valve for a boiler of given dimensions, unless the exact conditions under which the boiler is to be operated are known. The reference is frequently to the grate area; but, manifestly, this is by no means conclusive, unless it is known what kind of coal is to be burned, and how much of it.

Taking all things into consideration, the quantity of water evaporated, as per hour, is the best reference from which to decide upon safety-valve area; but how much water will be evaporated by a boiler of given dimensions, is a puzzling question that comes up. Still, there are conditions that largely prevail in the practice of this country, that, if taken into consideration, are not likely to lead far astray. Other conditions may be taken as exceptional, and treated accordingly. These conditions are: That the maximum quantity of coal used for steam-making, consumed per square foot of grate surface, is 17 pounds per hour; that each pound of coal will yield, *for steam-making*, 9,000 heat units; that every 1,000 heat units will, according to prevailing practice, evaporate 1 pound of water into steam within the limits of pressures ordinarily employed; that the number of pounds of water evaporated multiplied by .0055 gives, in square inches, the requisite area of safety valve to relieve the boiler from the danger of increasing pressure.*

Take, for example, a boiler of 25 feet

* I think one authority, assuming the quantity of water evaporated to be known, makes this multiplier .006, but am not quite certain.

grate area. According to the foregoing, we have $\left(\frac{25 \times 17 \times 9000}{1000}\right) \times .0055 = 21$ square inches as the safety-valve area required. This would demand two valves of the common type of 3½ inches diameter each, which would then be a little small by figures, but might be trusted. If more coal is probably to be burned, then the safety-valve area should be increased correspondingly.

It may be said this is going to extremes. Taking care of extremes is exactly what a safety valve is for. Failing in this, it loses its name, which reverts to the boiler attendant.

In the foregoing, the supposition is that the weighted lever safety valve is the only kind to be used on a boiler. Personally, I would use but one such valve on a boiler, however large, and that would in no case exceed 3 inches diameter. All that it would be necessary to do beyond what this valve would do, should be done by a "pop" valve, which, being set to blow a pound or two later than the lever valve, would be *the* safety valve; the lever valve, in the instance of a large boiler, being little more than a warning valve—its warnings to be heeded, if heard; if not heard, nothing worse than a little waste of steam would result.

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The Use of Shade Lines on Drawings.

BY F. A. HALSEY.

Among those who use and advocate the use of shade lines on drawings, there is a difference of opinion and practice in their use. Back of this is the greater difference of opinion as to the advisability of their use at all, but this will not be dealt with here. Many for whose judgment in mechanical matters I have the highest respect, object to them and do not use them. My opinion is that they add to the clearness of drawings, and by that fact are justified—the trifling amount of labor involved in making them being, in my opinion, a small price to pay for their undoubted effect in making the drawings plainer. This added clearness is, however, their only justification. They are not used for artistic effect or to show lines dividing surfaces in the light from those in shade, and right here is the point of divergence of opinion referred to.

This statement that they are not made to show the lines dividing light and shaded surfaces, is made because, for the purposes of working drawings, no one cares which surfaces are in the light or which are in the shade, or which lines divide one from the other. A recognition of this fact, and of the fact previously stated, that their only purpose is to make the drawings plainer, will clear away a lot of fog. If their only purpose and effect were to distinguish the light and shaded surfaces, their use could not be justified, as they would only involve useless labor in showing what no one cares anything about.

The following is an attempt to show that the light and shaded surface view is untenable, because it leads to many absurdities, and causes many lines to be drawn in a way which is the reverse of clear and would not, in fact, be understood by a large majority of those who have to read drawings—and it is for them that the lines are put on.

The use of these lines has usually been explained, with reference to light and shaded surfaces, by means of the conception of the light coming over the left shoulder, and the student is taught that lines dividing the surfaces in the light from those in the shade should be heavy, and all others light. Following this up, the one who attempts to be logical in the matter will say that the lower side of a horizontal cylinder, as in Fig. 1, should not be heavy, because it does not divide such surfaces, the lower portion of the cylinder, both the portion seen and that not seen, being in shadow.

If this were the end of the objection, it would not be serious, and might, to save controversy, be granted; but it is not. Consider the right-hand end of the same cylinder. From the top down to point *a* the line defining the end divides a surface in the light from one in the shade, and by consent of all, should be heavy; but below point *a* both surfaces defined by the line are in shade; and if the logic above defined is to prevail, this line should be heavy above point *a* and light below it. Is there anyone who will advocate such a practice?

To carry the logic further, the line defining the left-hand end of the cylinder is in a reverse condition. Above point *b*, on the same level as *a*, this line divides surfaces, both of which are in the light; but below *b* the cylindrical surface is in the shade; and if logic is to be followed, the lower end of this line should be heavy. Will anyone seriously advocate such a practice?

Another logical result of this view of the question would be to make the right-hand line of a hexagon nut, Fig. 2, light; while any view of the question from the light and shade standpoint would make the base line to the left of *a* heavy, and to the right of it light, because the right-hand face is in the shade. Did anyone ever see hexagon nuts so drawn?

Some purists in such matters will save themselves, as regards the left-hand end of the cylinder, by adding that, if the heavy line is to be used, the surface in the shade must be out of sight, or at most seen only by its edge. Unfortunately, as in the previous case, this is not the end of this contention. In Figs. 3 and 4 are shown in sectional plan and elevation, blocks having recesses in their front surfaces. In Fig. 3 the sides of the recess are perpendicular to the front surface, while in Fig. 4 they are slightly inclined to it. Lines *a* and *b* for the sides of this recess in Fig. 3, would by all be made heavy; but the contention that the shaded surface must be seen by its edge only, would make these lines *a* and *b* of Fig. 4 light. Now, if shade lines are of any use at all, it is in just such cases as this, in showing this recess to be such and not a raised projection, and for that purpose the heavy lines are just as useful in Fig. 4 as in Fig. 3. This may be seen by comparing Figs. 4 and 5—the latter representing a piece having a projection from its surface, instead of a cavity sunk in it. If we admit that the shaded surface may be seen, the resulting shade lines of the elevations of Figs. 4 and 5 define at once whether the piece has a projection or a cavity; while if the heavy line is to be used only when the shaded surface is out of sight, the elevations of Figs. 4 and 5 will be alike, as in Fig. 6, which makes no distinction between the cavity and the projection. There can be no question that Figs. 4 and 5 are clearer than Fig. 6, and that the heavy lines should be used whether the shaded surface can be seen or not, but the logical result of this conclusion is that the left-hand end of Fig. 1 must be made heavy below point *b*. It will be seen that the difficulties of a logical treatment of the subject from the standpoint of light and shade are thickening rapidly, but the end is not yet.

Fig. 7 shows a hollow cylinder cut in half. If this logic is to be followed, the shadow of the edge *a* must be cast on the inner surface of the cylinder as shown. Now, on this basis of procedure, the portion of the bottom line between points *b* and *c* must be made light, because the cylindrical surface above this portion of the line is in shadow, while the rest of it must be made heavy, as drawn. Is there a shop in the country where such a practice is followed, or would such a method assist anyone in reading drawings? And yet this is the logical method of showing this piece from the light and shaded surface point of view.

The condition of things shown in Fig. 7 is of frequent occurrence, and if shade lines are to be logically used from the point of view here criticised, constant casting of shadows is necessary, for no such line can logically be in shadow. The result of such a practice would be to rule out shade lines from many places where, in fact, they would be useful, and to make their use and significance unintelligible to the average man.

In Fig. 8 the projecting piece *a* casts a shadow which covers portions of the lower and right-hand lines, and if the heavy lines are to indicate the division between surfaces in the light and those in shade, these boundary lines must be drawn as shown; while were the piece *a* slightly shorter, so that its shadow did not reach those lines, they would be made heavy throughout—a distinction which it is clearly absurd to incorporate in working drawings.

Another illustration may be drawn from a screw thread. Those who insist that the dark surface should be seen by its edge only, can here be logical, and make all the lines of the screw light, but we have already seen in Fig. 6 the undesirable length to which this position leads us. If we follow the other plan and allow that the surface in shade may be seen, and proceed to draw the logically correct shade lines of a screw, we shall have some complicated shadow-casting to do before the lines are determined, with an unjustifiable amount of labor and a result that would justly excite derision anywhere.

Still another absurdity which the purists sometimes contend for, and which is strictly logical from the light and shade standpoint, is that while the light from pieces shown, thereby defining overlapping pieces from flush surfaces, and at a glance, and without reference to other views, distinguishing between projections and depressions.

Following this out, the lower and right-hand lines of Fig. 1 will be heavy, as shown; the desirable distinctions between Figs. 4 and 5 will be made, and such absurdities as Figs. 7 and 8 will be avoided.

This discussion is the result of recent criticism of this paper for making its engravings in accordance with the practice here advocated. If it will add strength to the argument, the writer may add that he has been driven to this position by the logic of common sense. I was taught the use of these lines from the conventional standpoint, but having the difficulties of that view of them forced to my attention

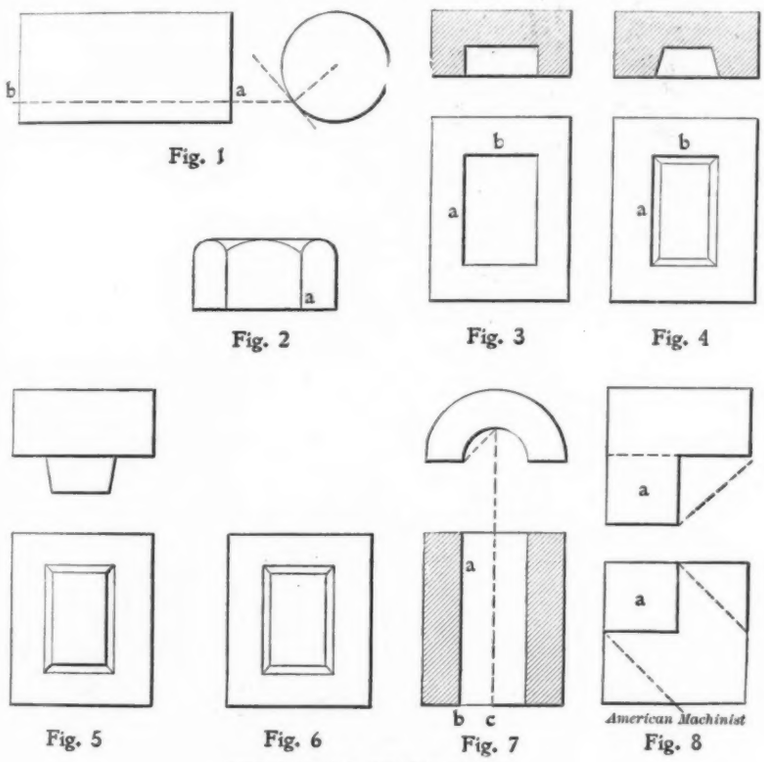

Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8

THE USE OF SHADE LINES.

over the left shoulder places the heavy lines on the sides of pieces nearest the lower and right-hand edges of the sheet in the elevation, it places them on the sides nearest the right and farther edges in the plan.

Shade lines drawn in accordance with the logic of the light and shade view of their purpose, will thus be seen to involve many absurdities, and there is little doubt that it is the contemplation of these absurdities which has led so many to say "fudge" and to abandon them altogether. The proper thing to do, however, is to throw such logic to the dogs; to abandon the idea that the heavy lines have anything to do with light and shade, but to follow the simple principle that these lines are simply a conventional device for defining the lower and right-hand edges of the by daily practice, and at the same time recognizing the real usefulness of the lines as an aid in reading drawings, the position here advocated has followed as a matter of necessity.

If it is granted that the purpose of these lines is to make the drawings plainer (and they can have no other justifiable purpose), then that method of using them which best fulfills this purpose is best. Inasmuch as the light and shade idea introduces complexities and anomalies, to no purpose except confusion, it is hard to see how it can be defended.

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A bill to abolish work with machinery in prisons has been introduced in the Pennsylvania Legislature. Work for its own sake is wanted there.

Practical Mechanics Without Arms or Legs.

Most of our readers will be surprised to learn that a person without arms or legs may be a practical mechanic, and yet such is the decision of a learned judge, as will be seen from the following extract from "Engineering News" for February 25th:

"A decision was given not long ago in Buffalo which will interest every engineer who has ever been under cross-examination on the witness stand, and has had a lawyer try to break the force of his testimony as an expert by attempting to show that he was not a 'practical' man. The city charter of Buffalo provides that the inspectors of buildings 'shall be practical building mechanics of not less than five years' experience in their trade.' The Board of Aldermen of the city refused to order a warrant drawn for the payment of a certain inspector on the ground that he was not a 'practical building mechanic.' The inspector appealed to the courts, setting forth that 'for more than five years prior to his appointment as a building inspector, he had been a student of architecture and building construction, theoretical and practical, in the offices of well-known architects, and had worked upon buildings of different kinds, and made plans for and superintended the construction of such buildings, and had inspected the work of their construction in all its branches. That he was thoroughly familiar, both theoretically and practically, with all the details of the mechanism and construction of buildings, and with building materials.'

"The judge, in his decision, fully sustained the position of the inspector, and his opinion is an admirable answer to those who still cling to the opinion that an engineer is necessarily a more 'practical' man because he has fired a locomotive, run a lathe, held a drill, or done some of the work of a skilled laborer in connection with engineering. We quote from it as follows:

" 'The words of the charter prescribing the qualifications of an inspector of buildings should receive such reasonable interpretation as will make them effective for the accomplishment of the ends sought, and that is, among other things, to exclude from the position in question inexperienced, unskilled, unfit and incompetent persons, and to secure the services of persons having a practical knowledge of the construction of buildings; and it would seem that the qualifications of the relator, as disclosed in his own affidavit, which is conceded to be true by not being denied, are of a high order, and that he is fully competent to pass upon the character and quality of all the material and workmanship which enter into the construction, altering and repairing of buildings of all kinds.

" 'It seems to me that his description of

himself and of his qualifications pictures to the mind a practical mechanic, who is especially skilled in the art of building, and acquainted with the rules and methods observed, prescribed and pursued by those engaged in constructing, altering and repairing buildings of all kinds, and possessing the skill to apply those rules and to adopt and follow those methods. He is, according to the record, skilled in all the trades which have to do with the construction of buildings, and such a person, according to the "Century Dictionary," is an artisan, a handicraftsman and a mechanic within the meaning of the charter.

" 'The relator is clearly a "practical" mechanic, because he has devoted himself for several years to the actual work of drawing plans for, and the construction of buildings of various kinds. I am of the opinion that it is possible for a person without legs or arms to become a practical building mechanic; that is to say, it is not necessary for a person to perform manual labor with the tools of any special trade or occupation to become such a mechanic. If such a person is competent to devise, direct and supervise the construction of all kinds of buildings in all their parts, he is at once an artisan, a handicraftsman and a mechanic. If he does all these things he is a "practical mechanic," whether he has ever touched a tool of any particular trade or handicraft, or not.' "

[As a matter of fact, the judge's decision is entirely indefensible. We are far from saying that the inspector in question is not an entirely competent man to discharge the duties of his position, but it is perfectly clear that he is not the sort of man contemplated for that work by the Buffalo charter. If any other proof beside the use of the words "practical building mechanics" were wanted, it is supplied by the requirement that the inspectors shall have had "not less than five years' experience in their trade."

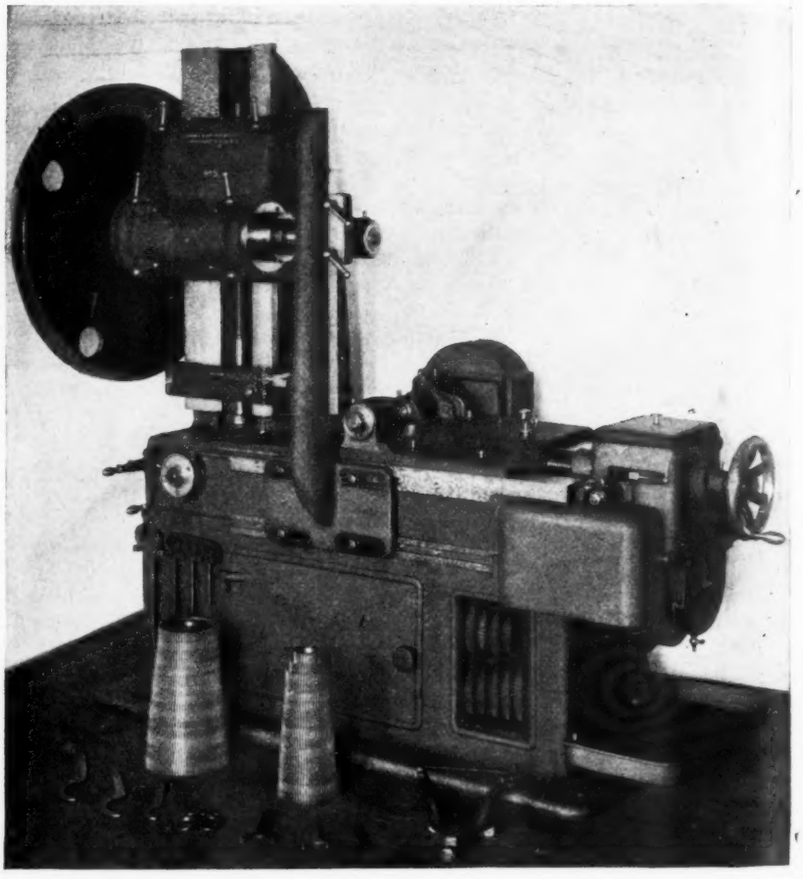
If "Engineering News" does not believe that the kind of man described by the charter is suitable for the work, or if it believes that others are just as capable and should be allowed to serve as inspectors, then it should quarrel with the charter—not uphold a decision which is plainly contrary to the intent of the law.

The inspector in question is, apparently, an architect, and we wonder if he or most other architects would consent to their occupation being called a "trade." For that matter, how many of them would assent to the judge's decision that they are mechanics? Our observation is that they are particularly insistent in declaring their occupation to be one of the most learned of learned professions, and we greatly doubt if this inspector, whether architect or not, would have asked to be considered a mechanic if his fee had not depended on it.

The requirements of the charter may or may not be wise, but it is plain that they prescribe that skilled workmen only shall be inspectors. An architect or builder may be an excellent judge of work, but that fact does not make him a mechanic, any more than the capacity to judge every course of a banquet makes a man a cook.

We have no reason to doubt that this inspector earned and deserved his money, but the most that "Engineering News" can properly say is that a wrong decision has righted a wrong law—and two wrongs are not usually believed to make a right.

All the judicial decisions in the world cannot alter the fact that what is universally understood as a practical mechanic is a skilled workman—with his hands.—Ed.]



Improved Automatic Gear-Cutting Machine.

The increased use of cut gearing, and the demands of machine constructors as to cost and quality of such gears, have been among the causes which have led to the design we herewith illustrate, which is an improvement on previous machines of the same class by the same builders. The general construction and method of operation of the machine will be readily understood from the engravings, and, in fact, it does not depart in essential features from its predecessors, but has been improved in a number of important details, as a result of experience with them.

Special attention has been paid to the protection of all the working parts from dust and dirt. The feed and working mechanism are placed at the end of the machine, inclosed in a case, and are made easy of access for changing the feed or examining mechanism.

The cutter spindle is driven by helical gears, which give a smooth and powerful action, and do away with the necessity of a belt tightener or other device for adjusting the belt. An outboard bearing is provided for the spindle, so that the cutter is supported by bearings each side of it, and the outer bearing is arranged to be easily removed when cutters are changed. The end adjustment of the cutter spindle is made by means of a worm and rack, and an indicator is supplied, multiplying in a ratio of about six to one, for setting the cutter central. The spindle is much larger than in previous machines, and the cutters adapted for it are now carried in stock.

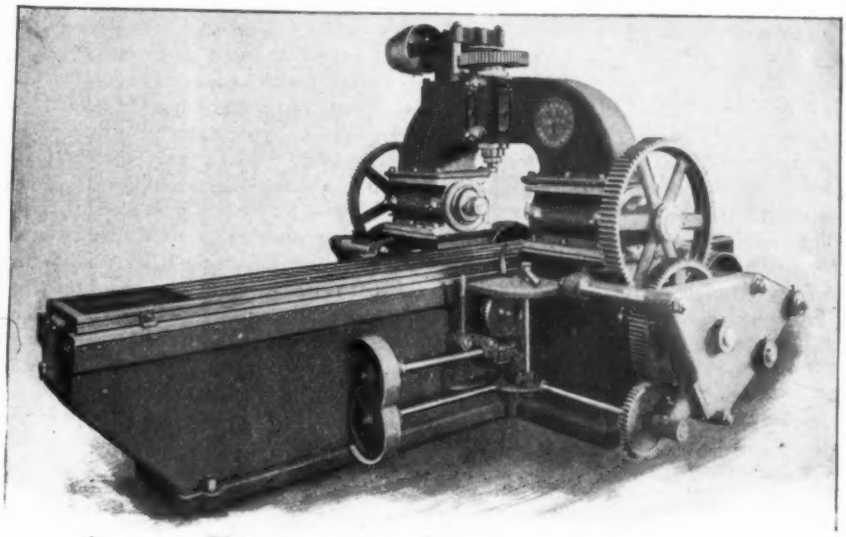
The mechanism for returning the cutter slide, and for indexing, is entirely independent of the drive when cutting, and for feeding, and thus the returning and the indexing are at constant and maximum speed, regardless of speed or feed at which the machine is working. The hand-wheel, used for moving the cutter slide by hand, disconnects automatically, and remains stationary when not in use. The machine has twenty-seven changes of feed, the intention being to secure the widest possible range, so that the maxi-

mum can be attained under any given conditions.

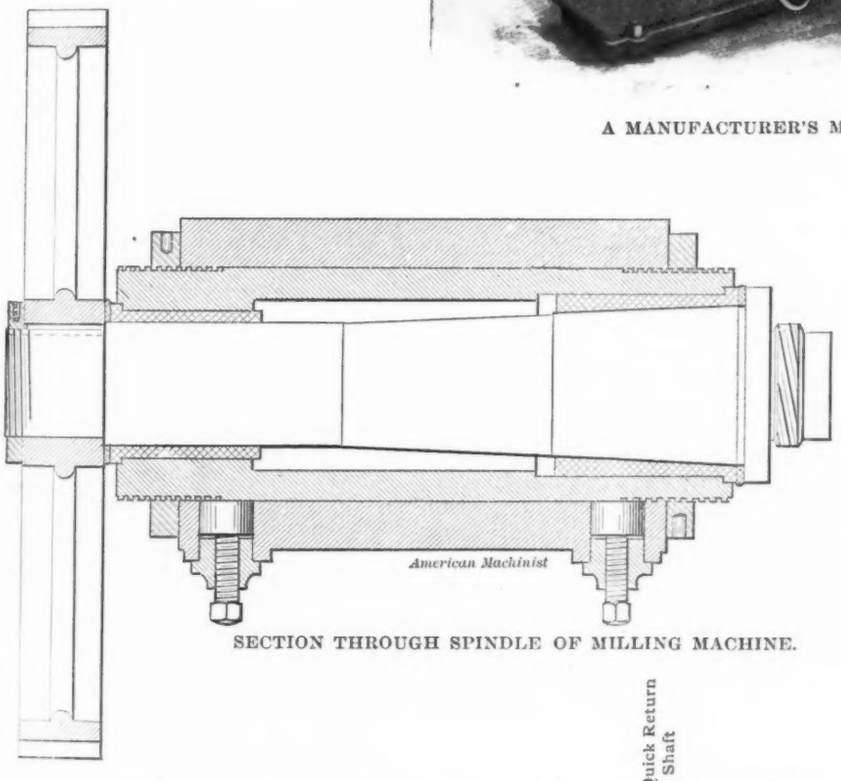
Special attention has been paid to insuring accuracy of division, and the indexed worm, though rigidly supported, can be readily disconnected, and the work spindle revolved by hand. The vertical adjustment of the work spindle is by means of a graduated screw, the graduations reading to 1-1000th of an inch, and the screw rests upon ball thrust bearings.

As shown, the larger machines have an outboard bearing for the cutter spindle, which is attached to the bed of the machine, but the smaller machines of this line have an overhanging arm for supporting the outer end of cutter arbor.

All nuts and bolts in the machine which are frequently handled in its working, are provided with permanent handles, thus doing away, so far as possible, with the use of wrenches. The machine is made by the Brown & Sharpe Manufacturing Company, Providence, R. I.



A MANUFACTURER'S MILLING MACHINE.



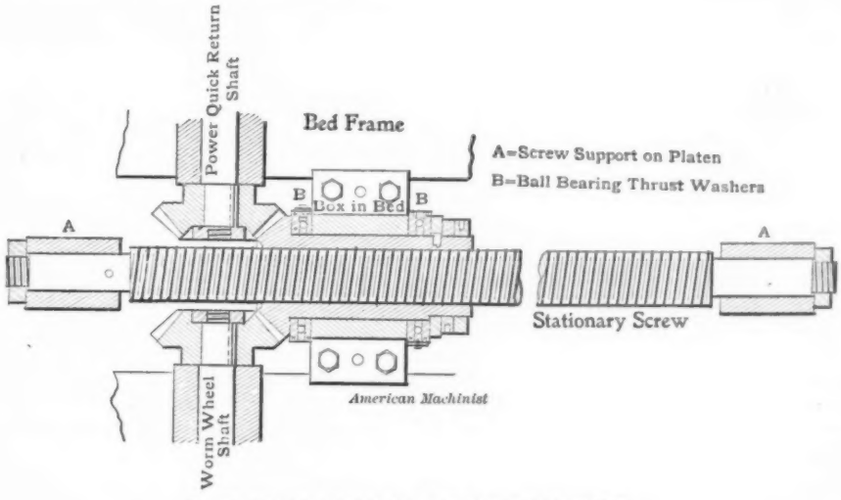
SECTION THROUGH SPINDLE OF MILLING MACHINE.

A Heavy Manufacturing Milling Machine.

The accompanying illustrations are of a three-spindle milling machine, recently constructed by Beaman & Smith, of Providence, R. I., and designed to remove, as rapidly as possible, the surplus material at each end of a cast-iron piece (leaving enough for a light finishing cut), and at the same time taking a finishing cut over a certain part of the piece, at right angles to the ends.

After due consideration, it was determined that the desired results could be accomplished in no way as rapidly as by the use of strongly driven and supported end mills, as they are free-cutting, comparatively inexpensive to make and maintain, and on work for which they are suitable the greatest production can be obtained. Therefore, there are two horizontal spindles, which run in bronze boxes, each provided with 3-inch horizontal movement for adjustment, and driven by a 4-step cone for 5-inch belt, through gearing in the ratio of 61 to 1, each carrying an end mill 14 inches diameter, having 70 teeth. Also a vertical spindle provided with 3-inch vertical adjustment, driven by a cone having three steps for a 3½-inch belt, through gearing in the ratio of 11 to 1, carrying an end mill 6 inches diameter, having 30 teeth. Fig. 2 is a section through the spindle boxes and sleeve of a horizontal spindle, showing the construction and means of end adjustment. The work is placed in suitable fixtures, which are on a table 10 feet long and 14 inches wide, provided with automatic feed and stop; also with quick movement in either direction, by power, at the rate of 15 feet per minute.

The feed is by a fixed screw with the nut driven by a cone having four steps, through change gearing by means of which a table feed varying from 1 to 12 inches per minute can be obtained. The rate of table travel or feed per minute was



FEED MECHANISM OF MILLING MACHINE.

considered one of the most important features, and a wide range of feed is provided for. The worm feed-shaft is provided with a friction drive to insure the slip of feed, should there be any abnormal strain on the feed mechanism.

The machine weighs about 12 tons, and requires a floor space of about 22 feet in length by 9 feet wide.

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The Zeuner and Bilgram Slide-Valve Diagrams.

An inquiry from a subscriber for a brief statement of the method of laying out these diagrams, leads us to give the following explanations and illustrations without demonstration:

In Fig. 1, which represents the Zeuner diagram, the diameter *a b* is made equal to the valve travel. The line *c d* is drawn at an angle *e c d* from the perpendicular

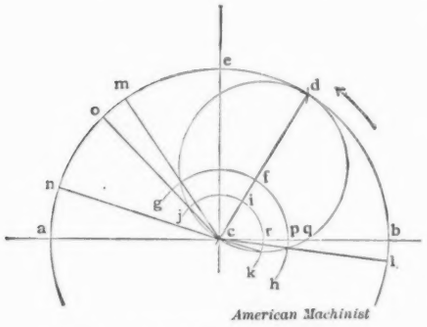

Fig. 1. THE ZEUNER DIAGRAM.

c e, equal to the angular advance, but in the direction from *c e* opposite to that occupied by the eccentric. That is, the direction of rotation in the diagram being that shown by the arrow, the line *c d* is to the right of *c e*, while the actual position of the eccentric is to the left of it. On *c d*, as a diameter, the valve circle is drawn, and from *c* as a center, and with radius

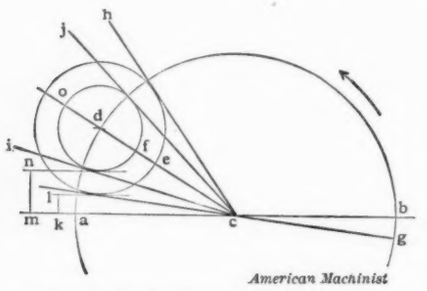

Fig. 2. THE BILGRAM DIAGRAM.

c f, equal to the steam lap, is drawn the arc *g h*, and similarly with radius *c i*, equal to the exhaust lap, is drawn the arc *j k*. The various radii being then drawn, the results are as follows: Crank position for lead *c l;* for cut-off *c m;* for exhaust opening *c n;* for exhaust closure *c o*; actual lead opening to steam *p q;* to exhaust *r q;* extreme opening of port to steam *d f* to exhaust *d i*. Should the valve have negative inside lead, or "inside clearance," the arc *j k* would be drawn as shown, but the positions of the crank for exhaust opening and closure would change places, and the extreme opening of the port to exhaust, instead of being $d\,i = c\,d - c\,i$, would be $c\,d + c\,i$.

In Fig. 2, which represents the Bilgram diagram, *a b* is, as before, equal to the valve travel. The angle *a c d* is made equal to the angular advance. From *d* as a center, with radius *d e*, equal to the steam lap, and with radius *d f*, equal to the exhaust lap, circles are drawn as shown. The various radii being then drawn, the results are as follows: Crank position for lead *c g;* for cut-off *c h;* for exhaust opening *c i;* for exhaust closure *c j;* actual lead opening to steam *k l;* to exhaust *m n;* extreme opening of port to steam *c e;* to exhaust *c f*. Should the valve have inside clearance, the positions of the crank for exhaust opening and closure would change places as before, and the extreme opening of the port to exhaust would be *c o*.

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Repairs of Electrical Machinery.—V.

BY A. R. HARRIS.

In the last article, the manner in which a series-wound multipolar armature is cross-connected was explained, and it was shown that in order to obtain mechanical symmetry it is necessary to drop one coil in one of the sections, and also one commutator segment. It was also stated that, electrically, the leaving or removing of this coil would make no material difference so far as the armature is concerned, but this is not strictly true with respect to the commutator, as will be seen at once from the following: In the figure given in that article, an eight-pole armature was shown, with 32 coils, or four to each section. By tracing the connections from one commutator segment to the one next to it, it will be found that the number of coils between successive segments is four, and, therefore, the tendency to spark will be that due to the action of this number of coils. If the odd coil is left in, and is connected with the adjacent one, there will be but one coil between the two segments to which these coils are connected, and, therefore, the tendency to spark as the brush passes this point will be much less than at any other point. This will disturb the equilibrium of the commutator, and might result in increasing the sparking; hence, it is desirable, on this account as well as for mechanical reasons, to leave the coil out. It must not be supposed that the space the coil would occupy is left vacant; this is not done; but, instead, the armature and the commutator are spaced so that the remaining coils and segments will fill up all the space.

When the armature is connected so as to be in parallel, with only two sets of brushes on the commutator to take off the current, the coils remain the same as when the number of brushes is equal to the number of poles. The connections between the commutator and the armature coils also remain unchanged, and the cross-connecting is all done in the commutator. Fig. 1 illustrates how this is done in the case of an eight-pole armature. In this figure there are 32 coils, and the direction of the current in all is shown by arrowheads. It will be noticed that segments 1, 2, 3 and 4 are connected with the coils where the direction of the current changes, and this is also true of segments *J K L* and *M*. Now, if the first four segments are connected together, and a brush is placed in contact with segment 1, and the second four segments are connected with a brush resting upon *J*, the current passing to or from the commutator through these brushes will divide equally between the four segments that are connected to each brush, and will flow through the eight separate paths by the armature wire. From the foregoing it will be seen that, to cross-connect a commutator for an armature wound in parallel, all that is necessary is to divide the number of segments in the commutator by the number of pairs of poles, and connect all the segments separated by this number with each other; thus, if there are six poles, equal to three pairs, and sixty segments, the connected segments must be twenty apart, since sixty divided by three equals twenty.

In order to make a mechanical job of the cross-connecting, the connections are generally of sheet metal, which is bent into the form shown by the dotted lines *a a*, *b b*, *c c*, etc. If the number of coils wound upon an armature were as small as that shown in the figure, there would be very little difficulty in getting the connections in place, no matter how they might be made; but as in actual machines the coils are vastly more numerous, it is necessary to use considerable judgment so as to not crowd the connecting strips so close together as to destroy the insulation between them. It is on this account that they are given the curved shape shown; anyone who will experiment a little with a pair of dividers and a piece of paper, will soon find that, by changing the shape of these curves, the lines can be made to come closer or be spread further apart.

Commutators cross-connected in this way sometimes give out by an imperfection in the insulation of the connecting strips, and occasionally the insulation is damaged in an accidental way, as when it becomes saturated with oil from the bearings, which is impregnated with metallic particles. Such injuries act in precisely the same way as a short circuit between the segments of the commutator in a two-pole machine, and in the majority of cases result in burning out the coils. By the position of the damaged coils, the defect in the cross-connections can easily be found, and it must be removed before

the machine is used again, as the replacing of the burned-out coils will not remedy the whole defect. A short circuit of this kind can be distinguished from one between two adjoining coils, or of a single coil short-circuited upon itself, from the fact that the latter will only burn out one, or both of the coils involved, while the former will destroy as many coils as there are pairs of poles, and they will be equally spaced around the circumference. When a commutator cross-connected in this manner is perfect, there should be no electrical connection between the adjacent segments; that is, when the commutator is disconnected from the armature. The connection of the armature coils with the cummutator, in this case, is just the same as if it were of the two-pole type, and all that was said in relation to the precautions to be observed in the latter, to prevent making improper connections, apply in the present case.

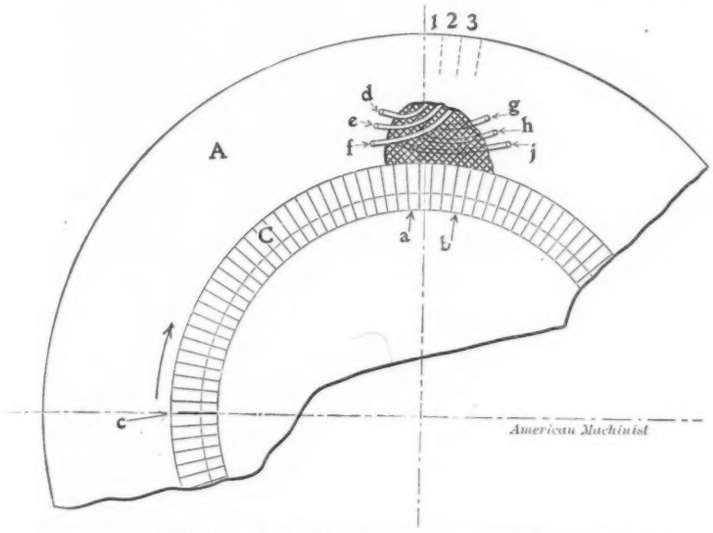

Fig. 2. SHOWING HOW TO TEASE OUT DISCONNECTED ENDS.

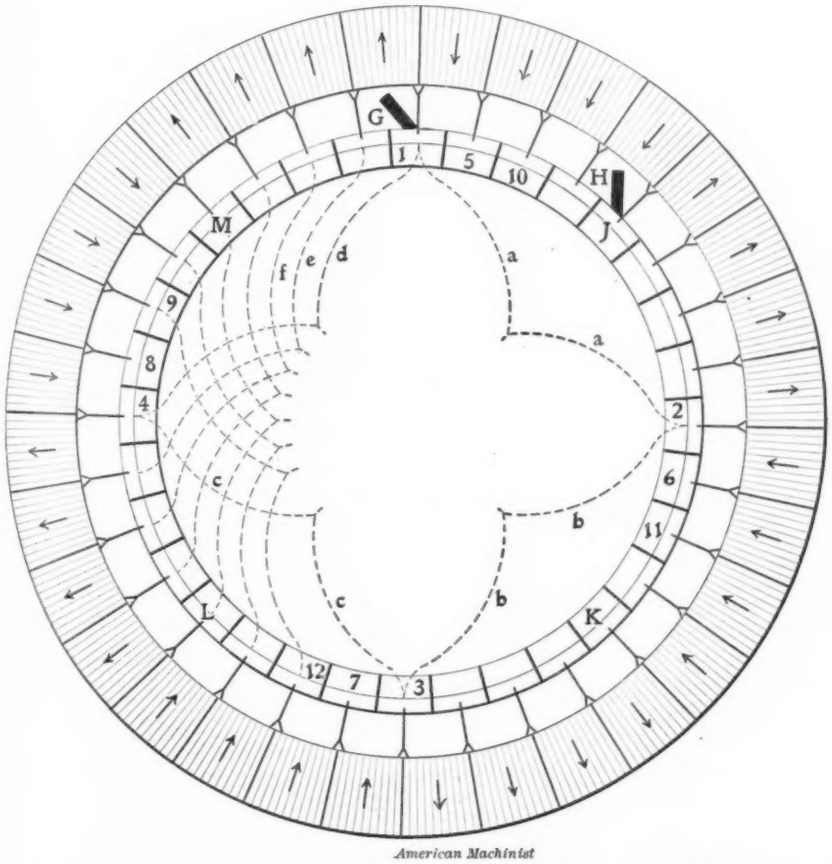

Fig. 1. PARALLEL-CONNECTED MULTIPOLAR ARMATURE WITH CROSS-CONNECTED COMMUTATOR FOR USE WITH TWO BRUSHES.

With armatures that are connected in series by cross-connecting the armature itself, in the manner explained in the last article, it is not so easy to trace out the proper ends whenever, by any cause, a number of the connections with the segments of the commutator become disconnected; but by resorting to the expedients to be explained in the following, the ends can always be found with certainty:

Suppose we have a case as represented in Fig. 2, in which there are six disconnected wires; this is a greater number than would have to be contended with, as a rule, but it is taken because the greater the number, the greater the difficulty. Three of these wires would come from the outside of coils 1, 2, 3, directly opposite; they could come from no other place. The other ends would come from the inside of coils, either to the right or left of the break. Suppose the armature is of the eight-pole type; then these wires would belong to coils one-quarter of the circumference from coils 1, 2, 3. This being the case, to segment *a* would be connected the inside end of the coil whose outside end connects with segment *c*, if the connections come from this side; but if they come from the other side, the outside end of the coil would be connected with a segment diametrically opposite *c*. Generally, the direction from which the wires *g h j* come can be determined by inspection; but whether they can, or not, we can ascertain in the following manner: Disconnect the wires from the segment directly ahead of *c*, in the direction indicated by the arrow; separate the ends, and with a magneto, or galvanometer, test ends *g h j* with the outside end connecting with segment *c*. If any one of these ends belongs to the same coil, the fact will be revealed by the test; if the outside end connected with *c* does not belong to the same coil as one of the ends *g h j*, then the inside end connected with *c* will be connected, indirectly, through a bottom and right-hand-side coil. Suppose we find that the outside end tried on the first test belongs to the same coil as end *j;* then, as *c* is one segment in advance of the one that corresponds with *a*, it follows at once that *j* must connect with the segment ahead of *a*, and also that the other wire connecting with this segment must be the one coming direct from coil 1.

Having found the proper ends to connect with the first segment ahead of *a*, disconnect the second segment ahead of *c*, and test the wire coming from the outside of the coil directly opposite it, with ends *g h*. If *h* is found to be the proper end, connect it with the second segment ahead of *a*, and to this segment also connect end *e* of coil 2. After this much has been done, there will remain but two ends, *g* and *f*, and these will have to connect with the third segment ahead of *a*. All this being accomplished, replace the wires disconnected with the two segments ahead of *c*, and after properly insulating the wires from each other, the armature will be

ready for use. Thus it will be seen that what, at first sight, is a hopeless confusion, can be reduced to actual simplicity, if we only know how the wires are connected with the commutator.

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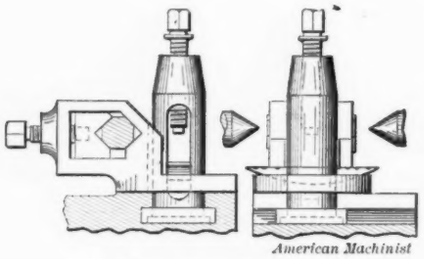
An Auxiliary Tool-Holder.

The device shown in the accompanying cut is the subject of a recent patent. It seems to require no explanation. The auxiliary tool-holder has a ring base which



A NEW TOOL-HOLDER.

goes over the regular tool-post, and is clamped by a tool held therein. A V-jaw, set up by the horizontal screw, may be used for clamping boring tools with straight, round or octagon shanks, larger than would go in the upright tool-post; or for certain jobs two tools may be set at once, as, for instance, a boring tool and a thread tool.

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British Frankness Again—American Tools.

The following article, which we clip from "The Practical Engineer," under the title, "The Necessity for Good Tools," is another illustration of this quality which we have before remarked of the English technical press. The recognition which American machinery is now receiving abroad is certainly most gratifying—the more so as the recognition comes to us by way of the pocket-book as well as by way of talk.

We regret to notice in the same issue of "The Practical Engineer," an illustration of the absence of this spirit, in its republication, without credit, of Mr. Sears' article on the "Thickness of Cylinder Walls," which was first published in our issue for January 21st. This, however, we are bound to say, is exceptional. In the many articles republished from our columns by the English press, we find very little cause for complaint on this account; in fact, we have come to look for a more careful observance of courtesy of this kind from that quarter than from our American contemporaries. The article first referred to says:

"At the anniversary dinner of the Manchester Association of Engineers on Saturday, Sir W. H. Bailey, in proposing 'The Trade of the District,' was emphatic in his appreciation of the value of good tools. He stated that in the United States, shops paying men 60s. per week could produce a given piece of machinery for a cheaper price than a firm in England could, although the latter had the advantage of paying only 36s. or 38s. He added that the cause for this disparity was that better and more accurate tools were in use in America than in England.

"The leading engineers of this country have long since recognized the fact that neither economical nor good working is possible without the employment of the best tools which can be purchased. There can be no question, however, that our American cousins were the pioneers of much that has been done to raise the standard of labor-saving appliances. In a country where, for many years, capable workmen were at a premium, and in fact sometimes absolutely unobtainable, the maker of a machine which dispensed with the services of even one man, found a ready and profitable market for his wares, and ingenuity was thereby always encouraged and stimulated, with the inevitable result that what was found to be wanting in the shops was soon forthcoming.

"Perhaps the difference between the two countries was also rendered more marked by the conservatism of our engineers of a few decades since, who rather regarded the toolmaker's representative as a man to be got rid of, rather than one to be consulted on some difficult point of machining. The tendency of many managers was then, perhaps, too much in the direction of avoiding capital outlays as long as possible, and of making a tool 'do' long after it should have been replaced by something newer.

"Competition, and the rapid interchange of opinions and ideas which now takes place between men of all nationalities, have tended to change all this. The users of tools of the highest class are keen to test any improvements which promise well, while the makers are on the alert to secure or adapt any new system which promises to render their productions more useful and more acceptable to their customers. On the question, too, of workmanship and accuracy there can hardly be a doubt that, comparing together the very best houses on either side of the Atlantic, they will be found to be at least equal, and no disadvantage rests with the English makers on these all-important points."

[We are inclined to think there are other reasons for our effective competition besides those given by Mr. Bailey. English mechanics who come over here to work do not attribute our greater product per man entirely to better tools by any means.—Ed.]

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Adjustable Packing for Journal Boxes.

The accompanying sketches are practically self-explanatory of an adjustable shim or packing piece, to facilitate the close adjustment of engine bearings or other pillow blocks, where precision and security are necessary. The packing pieces consist of two thin wedge plates, placed upon each other, and with their inclinations in opposite directions. The wedges each have a large slot in the center, one side of each slot having rack teeth, as shown. As the wedges are placed so that these rack teeth come upon opposite sides, a pinion working in the teeth of both wedges at the same time must move them in opposite directions. This adjusting pinion is upon, or is a part of, a spindle which may be turned as required for the adjustment of the wedges, and then securely fastened. For flat boxes, the pinion spindle has a thin head, larger than

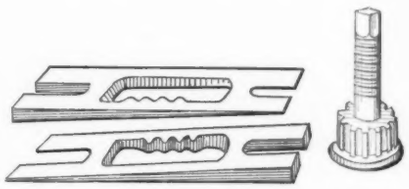


Fig. 1

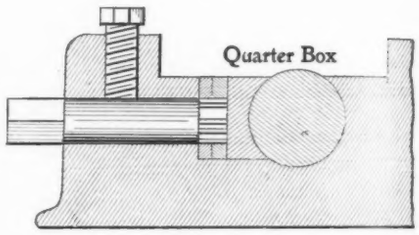


Fig. 2

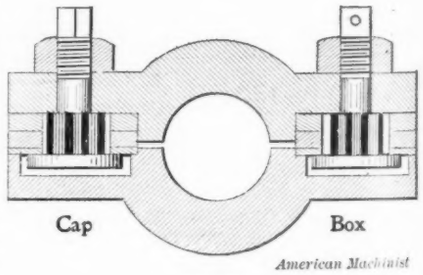


Fig. 3

ADJUSTABLE SHIMS.

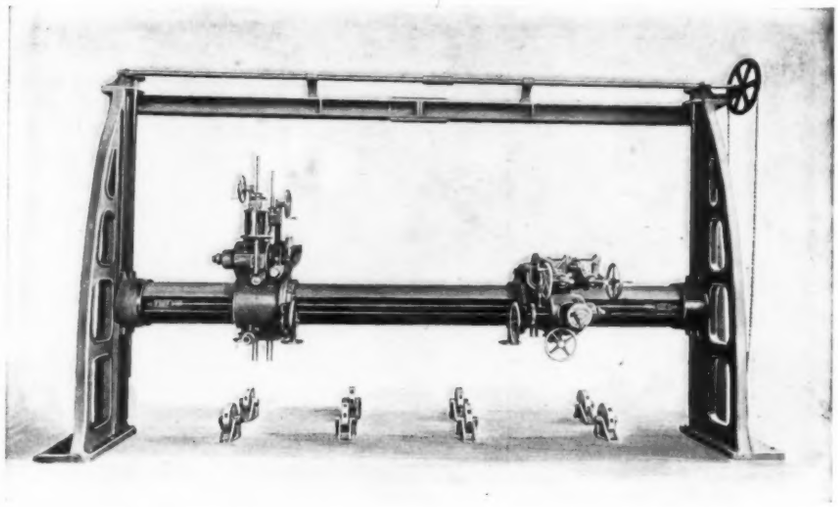
the pinion, and the spindle is then secured by a nut on the outer end. For the adjustment of quarter boxes, the body of the spindle is as large as the larger, or outside, diameter of the pinion, and then it can be slipped in after the wedges are nearly in place, and fastened by a set-screw on the side, as shown. The wedges need not have much longitudinal range, as when they can go no further in either direction, parallel shims may be slipped in or taken out to make the required total thickness. When the wedges are properly set, the cap may be bolted down solidly and securely upon them.

This device is the invention of J. A. Sanford, of Jackson, Mich., who informs us that he has used it in a number of cases with good results.

Electrically Driven Boiler Shell Drilling Machine.

There is an undoubted movement in this country toward the drilling of rivet holes in boiler shells after the bending of the plates, and we illustrate with this a new drilling machine for this purpose, which has just been put on the market by Thos. H. Dallett & Co., of Philadelphia.

The general arrangement of the machine, and the method of supporting the boiler shell by rollers placed on the floor, will be apparent from the engraving. The drilling heads will be seen to be supported by a heavy cross-beam supported by uprights and adjustable for hight. The heads are adjustable horizontally along the beam by a fixed screw and revolving nuts. The heads also rotate by a worm gear about the cross-beam, so that holes may be drilled at any position between vertical and horizontal, and 30 degrees beyond. An additional adjustment, which is not apparent from the illustration, is in a direction perpendicular to the length of the supporting beam. The range of this movement is 4 inches, and it is intended to facilitate the exact location of the holes by a more delicate adjustment than that afforded by turning the boiler shell on its supporting rollers.



ELECTRICALLY-DRIVEN BOILER-SHELL DRILLING MACHINE.

Each head will be seen to have its motor bolted to it in a manner which makes the motors an integral part of the machine. The motion is started and stopped, and the speed controlled, by a controlling rheostat placed in a convenient position. Each head has two drilling spindles, which are driven by the same motor, but are independent in their feed arrangements, which are automatic. The spindles of each head are adjustable in their distance apart, the minimum distance being 4 and the maximum 8 inches. The automatic feeds cover a range between .005 and 1 inch per revolution, and a quick hand-feed is also provided, which is also arranged for staybolt tapping, to further provide for which the spindles are given a traverse of 18 inches.

The size and capacity of the machine may be judged from the following dimensions: Extreme distance between centers of spindles, 16 feet 4 inches; vertical range of cross-beam, from 2 feet 3 inches to 9 feet 8 inches above base line, measured to center of drilling spindle when in a horizontal position; total hight of machine, 13 feet; and length over all, 22 feet.

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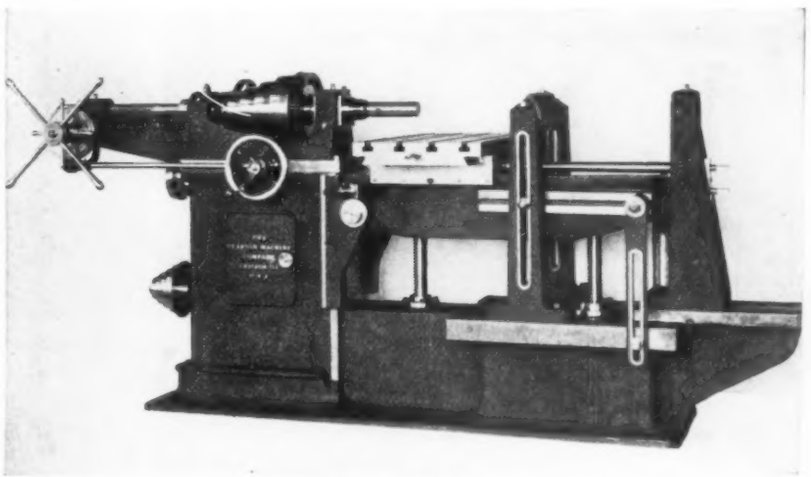
New Horizontal Boring Machine.

We present herewith an engraving of a horizontal boring and drilling machine of the Bement type, which differs in some respects from the usual construction.

Instead of the knee and table being of one solid piece, there is a joint at the top of the knee, as shown, the connection being by a large bolt which passes through both knee and table, and can be tightened by a nut at the back side of the machine, thus making the connection rigid after proper adjustment has been effected. This enables the table to be brought into alignment at any time, without danger of cramping the knee in its bearing upon the column. Then the front bearing of the spindle is made adjustable vertically, so that after the above named adjustment has been completed, the spindle can be brought into absolute alignment with the table.

Other points of novelty in this machine will be noticed in the outer supports for the table and the boring bars, and to illustrate these we are obliged to select a photograph showing the machine in a condition in which it is not intended to be used. In addition to the usual outer support for the boring bar and table, there is, at the end, a movable column which is also adapted to support the boring bar and to be clamped to the outer end of the table. This is for use in cases where the ordinary rest would interfere with the work. Where the work is of such a nature that either of these supports would interfere with it, then both can be removed, and the slotted links shown at each side of the table can be used in place of them, merely to support the table vertically. In this latter condition it is evident that the outer extremity of the table would have no lateral rigidity, but it is probably intended to use the machine thus only where it is positively necessary, and where lateral rigidity at this point may not be important, or can be secured in some other way.

It will be noticed that the screw for moving the saddle upon the table is covered by tubing arranged like telescope slides, so that it is protected from dust and dirt. Other features will be readily understood from the engraving. The machine is made by the Pearson Machine Company, Chicago, Ill.



NEW HORIZONTAL BORING MACHINE.

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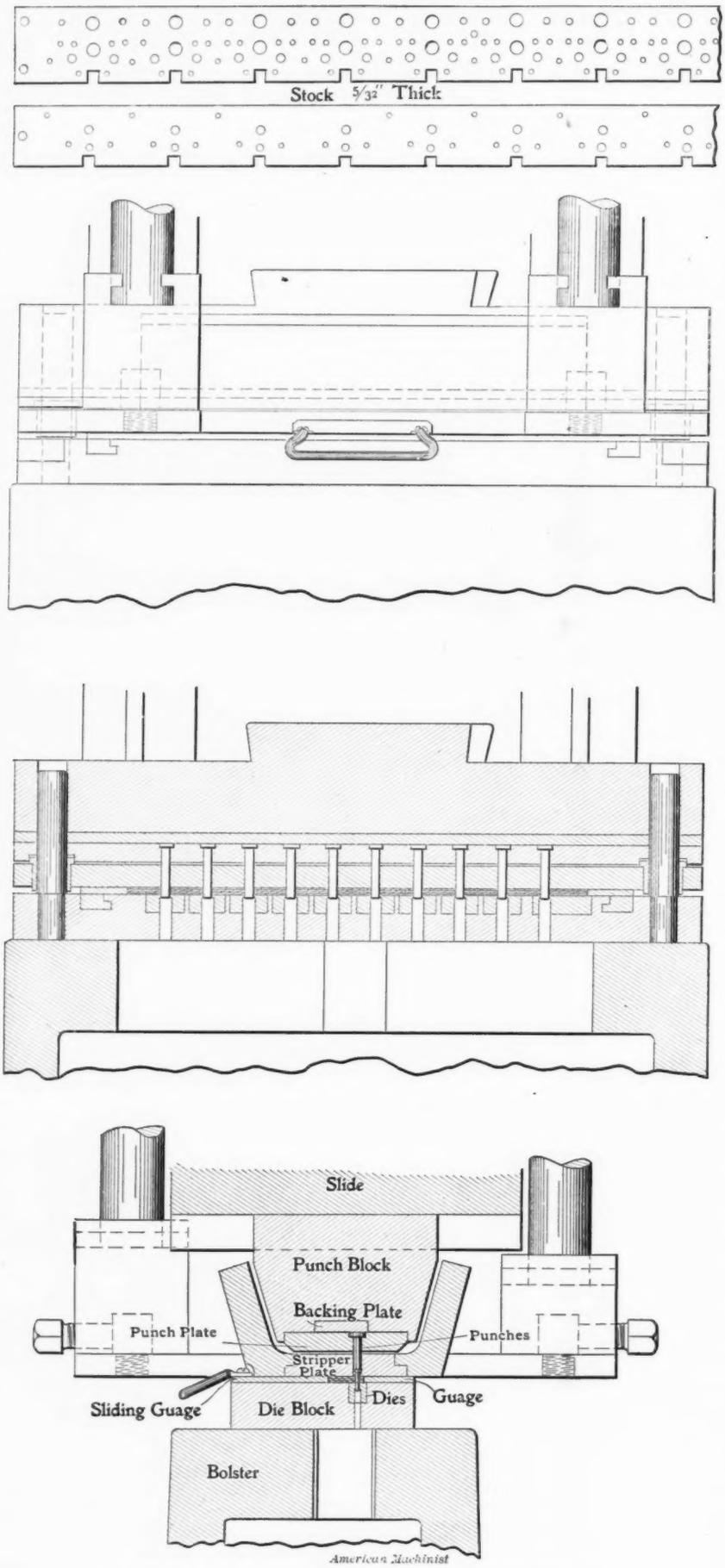
Building operations in New York City for the present year, it is estimated, will amount to at least $125,000,000, and about one half of this will go out directly as wages. Some other cities are also building at nearly proportionate rates.



DETAILS OF PUNCH, DIE, STRIPPER AND WORK.

Punching Press with Cam-Actuated Stripper.

The press shown in the accompanying half-tone should be of interest to our readers, as showing the possibilities of up-to-date punching practice, and as suggesting to what extent the press is now usurping the function of the drill. The principal noticeable feature of the punch here shown is in the cam-actuated stripper device. Piercing dies having stationary strippers are quite liable to distort the plates which are pierced by them, to such an extent as to require subsequent straightening. The stationary strippers are also a great hindrance to rapid and accurate work, the blank having to be placed under them and withdrawn from them in a very inconvenient and time-taking manner. In the present punch, the stripper plates are attached to four heavy vertical rods, and these receive motion from two cams on the main shaft. When the stripper is up, a free space is left between punch and die, enabling the operator to manipulate and observe his work quickly and accurately. The stripper plate comes down on the blank first, straightening it and clamping it tight before the punches enter, and holding it while the punching and stripping is being done, and the work comes out perfectly straight and true. As the stripper plate moves up and down with the punches, they may be made shorter than the stationary stripper would permit, and the punches used are therefore more resistant and lasting. This stripper also enables the punching of smaller holes in proportion to the thickness of the stock, the stripper acting as a guide for the punches up to the moment when they enter the stock.

Fig. 2 shows in detail the punch holder, punches, stripper, gage, blank and die, and their relations to each other. The upper plate shown in Fig. 2 is a sample of the work done by this punch, being a telephone switchboard plate containing 00 holes of different sizes, all punched at one operation. It will be noticed that most of the holes are considerably less in diameter than the thickness of the plate. Our readers can easily estimate for themselves how long it would take to drill these holes and how much time is saved by the punching. The press has a 6-inch shaft, weighs about 15,000 pounds, measures 24 inches between the housings, and is geared to 1 to 7½. It is built by the E. W. Bliss Company, Brooklyn, N. Y.

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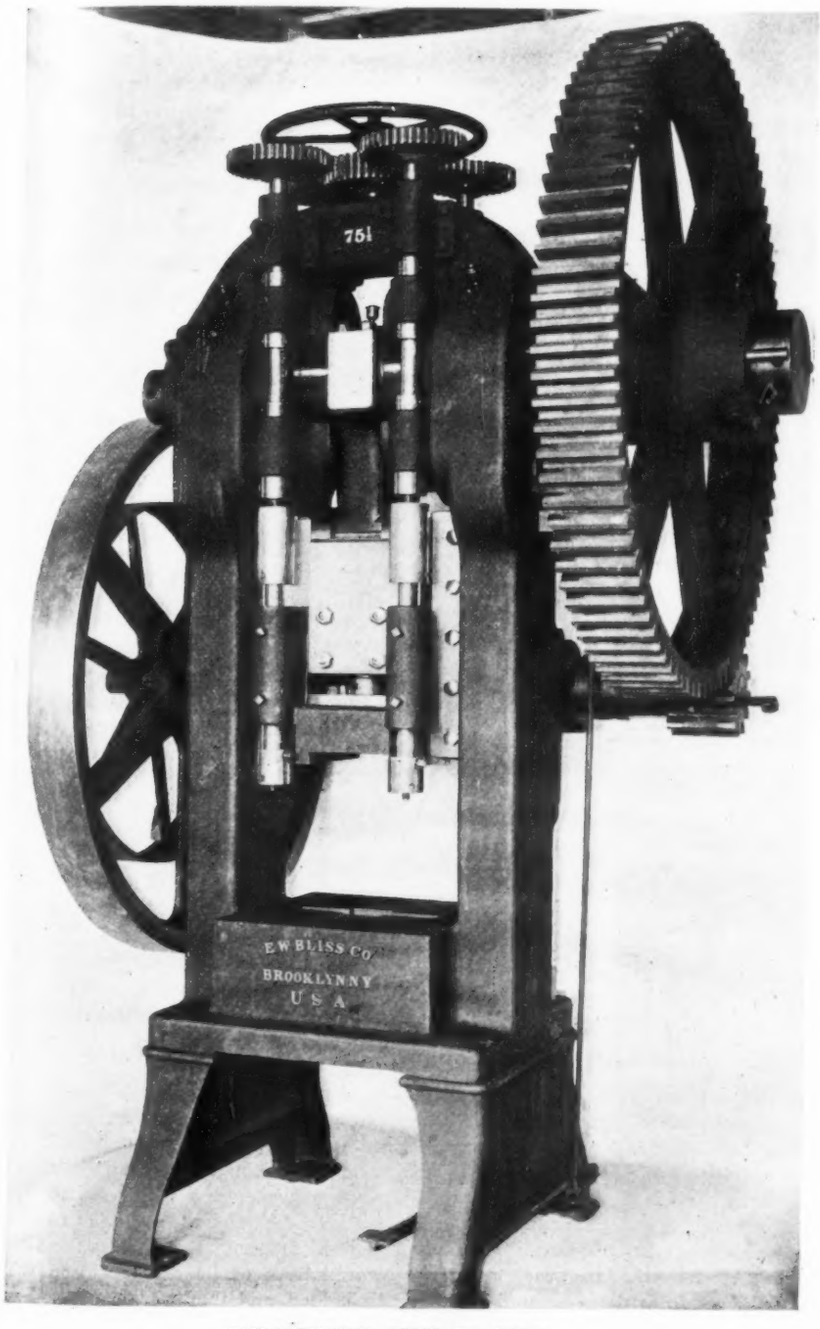
A friend sends us an account of a strange accident which befell Mr. Adam Reisinger, a Pennsylvania Railroad engineer. One of his main pins was running hot, and as he was about to remove the cap of the rod-cup, it was blown off, striking him just above the eye and knocking him senseless. It is supposed to have been caused by the generation of gas from the heated oil.

Carbolic Acid for Tempering.

Carbolic acid is recommended for tempering steel tools. A French writer tried it with cold chisels and secured much better results than with others of the same batch tempered in water. The chisels were each heated to a cherry red for tempering and otherwise treated alike. Tests were also made with two puddle steel bars which were heated to a white heat and tempered in water and in carbolic acid, respectively. The bar tempered in carbolic acid showed a finer fracture. While the carbon contents of the steel were not increased, the acid-tempered bar showed more elasticity and pliability than the other, while its hardness made it most suitable for tools.

Foreign Postage.

We frequently receive, from our foreign friends, appeals to make it known here that foreign postage should in all cases be fully prepaid. If it is not, considerable trouble, delay and extra expense result. One English firm writes us that fully nine-tenths of its American correspondence reaches its hands underpaid. Five-cent stamps should be placed upon letters and two-cent stamps upon postal cards.



CAM-ACTUATED STRIPPER PRESS.

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A Correction on Grinding.

Editor American Machinist:

In Mr. Arnold's article on grinding, February 25th, page 24, speaking of Fig. 5, where he says, "This bar was ground to one size the whole length within .0025," we find this is a mistake of ours in writing him. There should be one more cipher, making it one-quarter of one-thousandth, and not two and one-half thousandths. The same error occurs again in speaking of Fig. 6. Kindly correct this, for, as it stands now, it makes the statement ridiculous. The mistake is with us.

BROWN & SHARPE MFG. CO.,
per C. H. Norton.

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Letters from Practical Men.

Method of Advancing Legislation in Favor of Engineers' License.

Editor American Machinist:

Your editorial in the issue of February 25th concerning license laws for engineers, calls attention to a very important matter, and inasmuch as petitions for such laws are under consideration by legislative committees in several States, a few words concerning the cause of failure to secure such laws in the past, and some suggestions as to what might be done at the present time to secure much needed reforms will be of interest.

There can be no doubt of the necessity of properly administered, conservative laws to regulate the employment of competent men to operate and care for steam boilers, but the public need to be convinced that such measures are for the greatest good of the greatest number, and not solely for the benefit of a comparatively few engineers, for, as a rule, legislatures do not favor class legislation, but aim to enact laws for the good of the general public.

Many people have an idea that if they allow a license law to be enacted, the salaries of engineers would advance at once, but no greater mistake could be made, for the simple reason that this matter will always be regulated by the law of supply and demand, and furthermore such an assumption implies that men who understand the duties and responsibilities of an engineer are scarce, which is far from being true.

There are several cities in the Union where license laws are in force, and have been for some time, but no great rise in wages resulted from their enactment, and a moment's consideration will convince anyone that, if such were the case, it would soon be known in other cities, the consequence being that there would be many more applicants than could be furnished with situations, for there are always good men who are willing to remove to another city, if they can earn more money by so doing. One reason for the indifference shown by some engineers to the passage of such laws, and the opposition of others, is that they think some ill-advised inspector will make the examinations so hard that they cannot pass them; hence will be out of their situations.

While this is within the limits of possibility it is scarcely probable, and such a state of affairs could not last long, even if it should be inaugurated. Every bill presented for enactment should have some provision for an appeal from the decision of the inspector, for there is a chance for them to be mistaken as well as other people.

One of the greatest causes for failure to get these laws passed, is mismanagement on the part of those having the matter in charge. In some cases at least, the plan is carried out as follows: Some organization of engineers will decide to present a bill and try to have it passed. A committee will be appointed to take charge of the matter, and so far the arrangement is good; but if this committee and a few of their friends put in an appearance at the time and place appointed for a hearing before the legislative committee, they seem to think that they have done all that is necessary, the consequence being that there are as many, and perhaps more who appear to oppose it as there are to favor it, all of which has its legitimate effect.

The first duty of such a committee is to impress upon the minds of whoever appoints them or causes them to be appointed, that even with the most careful management, there will be some expense attached to the movement; for, in the first place, every organization of engineers in the State, without regard to name or condition, should be notified of what is desired, and asked to assist in forwarding the good work. Furthermore, the progress of the movement should be reported frequently, in order to keep the matter agitated. With the advantages of the printing press and cheap mail delivery that we enjoy, this is neither a difficult nor an expensive matter; but it does require some enterprise and energy on the part of the committee. Notices of the time appointed for a hearing of those in favor of the law should be promptly sent to every organization interested, and they should be requested to send as many delegates as possible to favor the bill. This will certainly also have its legitimate effect, both in the numbers present to urge their claims, and to show that there is something more than a local demand for the bill to become a law.

All this can easily be managed through the various organizations, and failure to attend to these details will cause disappointment in the future, the same as it has in the past. Another point that is certainly worthy of attention, is that there is a great army of engineers in every State, who belong to no organization of their craftsmen, but whose votes and influence are too valuable to be ignored. How to reach them is a problem that I will present, but cannot offer a practical solution of. Let those who have this matter in charge, in the several States, take measures to interest all of the engineers, and the prospects of securing equitable laws for the preservation of life and property will be much improved.

W. H. WAKEMAN.

New Haven, Conn.

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Steam Engines at the Gas Exhibition.

Editor American Machinist:

Noting in your issue of the 11th instant, in the report of the Gas Exposition, "The anomalous feature was the presence of several steam engines driving pressure blowers or exhausters," we are led to inquire why this remark was necessary.

So far as we are informed, all the gas consumed in the exposition, and all the gas manufactured in New York, or in any other town of importance, is pumped at some point with a rotary exhauster, which exhauster is driven by a steam engine, either directly or indirectly. Such remarks are not likely to favorably reflect on either the manufacturer of such machines or on the managers of the exposition.

JNO. S. WILBRAHAM.

Philadelphia, Pa.

[Our correspondent seems to have found in our remark more than we put into it. The remark was not "necessary," but, under the circumstances, it was one likely to have been made by any visitor to the exhibition. It was a gas exhibition, with gas engines standing around looking for something to do. It would have been the most natural thing in the world to have had gas engines supply all the power (which was not of great amount) that was used at the exhibition. It did not seem to be quite consistent, under the circumstances, to use the steam engines, especially when such an effort was made to bar out electricity. As to whether the gas engine or the steam engine would have been preferable for the service, there was no visible evidence, and no "reflection" was possible under the circumstances.—Ed.]

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The Inventor of the "Martini" Rifle.

Editor American Machinist:

In your issue of the "American Machinist," February 11, 1897, I see a notice of the death of M. Martini, "*inventor* of the Martini rifle." Now, I would not detract from the Swiss gunmaker's fame in the least, but I believe in giving credit where credit is due, and wish to say a word about this justly celebrated rifle:

The Peabody rifle was invented by Henry O. Peabody, of Boston, and the patent for the same was dated July 22, 1862. The arm was adopted by several European governments, and also by some of the States, as an arm for the militia.

While the gun was in the hands of the Swiss Army Board, M. Friedrich Martini, a Swiss gunsmith, applied for a patent on an "improvement to the Peabody breech system." This improvement consisted in discarding the outside hammer, or lock, and substituting an inside firing pin actuated by a spiral spring. Mr. Peabody had anticipated this design by about four years, and put it aside on account of the prejudice at that time against spiral springs in military rifles. England adopted the rifle with Martini's firing pin, and *rifled the barrel*, on the theory of Alexander Henry, a Scotch gunsmith, and called it the Martini-Henry.

And just here a word about this same Alexander Henry. He came to the United States in 1874, and instituted suits for damages against some of our arms manufacturers; the decision of the courts was adverse to his claims, as it was shown that what he claimed to be his invention had been long in use in our sporting rifles.

England's calling the arm the "Martini-Henry" was a gross injustice to the original inventor, and this injustice is aggravated by appending to the name of one man whose claim is simply that of an improvement, the name of another who has been proven to have no claim at all to anything.

These are some of the facts about the rifle in question, and it is but justice to Henry O. Peabody, if he is living, that they should be more generally known.

WILLIS H. BROW.

Fall River, Mass.

▲ ▲ ▲

Runaway Engines and Governors.

Editor American Machinist:

We hear many ideas advanced as to the cause of engines running away, more especially in electric stations, while the wonder is that the runaways are so few. A single-valve engine can be made that will regulate closely, from no load to a full load, if it is operated non-condensing; but put a condenser on and there is trouble with a light load. Without a condenser, the compression would hold the engine; but when the condenser is put on, most of this compression is taken off, and the engine becomes a different machine.

At one station I set out to save 40 per cent. in their fuel account, and, among other things, I put in a condenser. They were instructed to start up their 14 x 18 single-valve engine with a vacuum, and without load, so as to see what to expect. It was apparent at once that the throttle would have to be nearly closed with a light load, and they were cautioned when they threw off the street lights to look out for the engine. These were thrown off that night when the moon came up, about 10.30, and the engineer tried to straighten things out with the throttle, and the 16-candle lamps were a surprise, being some of the time 25 and some of the time 1 candle-power. He would shut the throttle clear down, and then give it two or three turns open. I finally took hold of it and shut it up, so as to know where to start from, and then gave the wheel about

half a turn, and soon had it regulating all right. Then a mark was made on the wheel, so that the engineer would know how far to open it with a light load; and when a heavy load was thrown off he could turn the wheel a certain number of times and stop at that mark, and after that he had no trouble.

We occasionally have the same trouble with four-valve engines, although there is no excuse for it. If a governor is made

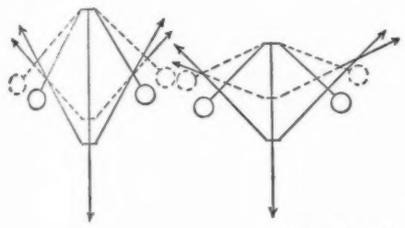

Fig. 1 Fig. 2

so that the angle of the links will have no greater change than shown in Fig. 1, the valves set so that the governor at its highest point will prevent the valve from opening, so that the engine will get no steam, and have the total rise of governor, from commencement of cut-off to taking no steam at all, not to exceed 2½ inches, there will be no danger of the engine running away, and the regulation will be good if the governor parts are light and

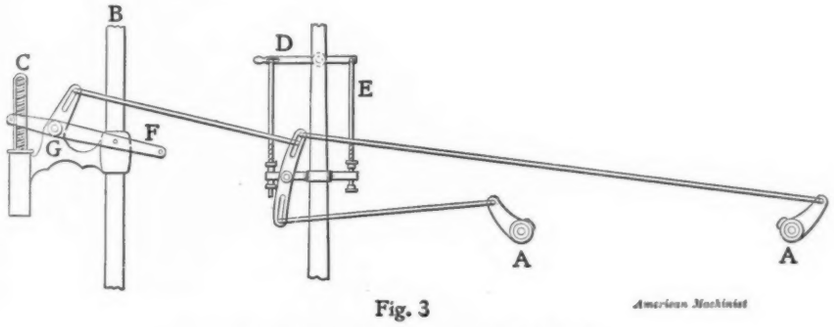

Fig. 3

RUNAWAY ENGINES AND GOVERNORS.

frictionless. The governor should have a counterweight and run fast.

A builder promised to build a governor as mentioned, but, instead, made it like Fig. 2, with a rise of 4 inches, and when in its highest position it can be seen how the direction of the pull on the links operates to move the sleeve that controls the cast-off tappets. The pull is nearly at right angles, and this engine, calculated to run at eighty revolutions, would vary from seventy to above ninety —just how far, it could not be told, as then the throttle was closed. The erecting man did not dare to start with the condenser, because the engine could not be controlled. This governor was finally brought down to about 2¾-inch rise, the valves set so that the steam could be entirely shut off, and it would control the engine within about six revolutions. This engine, with two others that regulate about the same, was built by a firm that stands among the highest in the country. The regulation of these engines is so poor that it gives a big "boost" to makers of single-valve engines.

One of the worst cases of governors for Corliss engines is copied from memory and shown in Fig. 3. *AA* are the tappets for releasing the valves; *B*, governor-stand; *C*, dash-pot; *D*, lever on shaft communicating with low-pressure cylinders; *E*, rod to change low-pressure to fixed cut-off; *F*, lever receiving motion from governor, and transmitting it to the other levers, bell cranks, etc. On the opposite side of this lever is another, on which slides the weight for speed adjustment. All the levers in this rig are cast-iron and very heavy. The rods are ½-inch extra heavy pipe. The dash-pot piston has a cast frame, as shown at *C*, in which are two coiled springs of about ¼-inch wire. The object is that should the piston in the dash-pot not move free enough, from the oil being too thick, these springs would compress. It would, however, take a good many pounds to compress the steel springs. This piston, with frame, springs, etc., will weigh some 10 or 12 pounds. This, together with the sliding weight and heavy levers, brings a heavy friction on the bearing *G*.

It was attempted to make this governor work with only 2½-inch rise. When the speed got high, so that the governor could overcome the friction of all the heavy weights, it would start the whole rig and go clear to the top, shutting off all the steam. When the speed got low enough to start the other way, it would come down with a slam, giving steam full stroke. It was then changed to give the governor somewhat over 4 inches rise, and that gave it a little better control, so that by nursing it when starting, it could be got, in the course of ten minutes, so that the voltmeter would keep within some 3 or 4 volts if the load was steady and there were no disturbing influences anywhere to alter the governor. Such a thing, however, as letting the vacuum down 10 inches upsets it completely, and the voltage will change 30 or 40, until it finally gets settled again.

The designer of the rig must have been an advanced drawing-school graduate, for the curves and angles are beautiful, if we take it as a work of art, and it required a great deal of study to evolve the whole thing and apply it to a steam engine. He could not have been a mechanic, for one of the first things a mechanic learns is, that it requires force to move mass, that more force is required to start mass than to continue it in motion, therefore mass, except in the counterweight, is inadmissible in the connections of a steam-engine governor.

I once saw an engineer start up an engine designed to run 78 revolutions, that was running over 100 before steam was shut off by the throttle. Examination revealed the fact that he had been at work on the governor, using a block of babbitt metal for driving the pins, and had left this block of metal on the top of the counterweight, and this prevented the governor from shutting off the steam. If the engine had been smashed, the block of metal would simply have been knocked off, and when the investigation came, there would have been nothing to tell the cause. When fly-wheels are run up to nearly the limit of safety, it is surprising that more do not give out.

W. E. CRANE.

Waterbury, Conn.

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Short Gear Teeth.

Editor American Machinist:

I have read with much interest the correspondence on the subject of short gear teeth in the recent numbers of your valuable paper. Having been interested in the manufacture of gearing for the past thirty years, I can appreciate the present tendency towards a shorter tooth for standard than heretofore. One of the principal reasons, not generally understood, for having gear teeth with length as much as .75 of the pitch, was on account of mortise gearing; that is, where wooden teeth had to work with iron teeth. In the very earliest of works on gearing we find that the teeth of gears were of reasonable length, from .5 to .65 of the pitch, and in after years there was a tendency to lengthen the teeth from .6 to .75 of the pitch. This for reasons given. This innovation was brought about principally in the manufacturing districts of England, where the mortise gear was substituted for iron-and-iron gearing to avoid noise. The short tooth, .5, in the mortise gear will wear more rapidly than when the length is .75. As manufacturers did not care to have different standards of length for their gear teeth, the length .7 and .75 gained favor for all kinds of gearing.

The result is that, say, within the last ten years there has been a decided reaction in favor of the original length of teeth, and in some cases where great stress and slow speed has been an absolute neces-

sity, teeth have been introduced successfully as short as .4 of the pitch.

The writer would refer your readers to the "Street Railway Journal," of New York, for the month of February, 1896, page 121, for a description of possibly one of the most extreme cases of variation in length of teeth, with a finale in favor of the short tooth. Since the publication of this in the "Street Railway Journal," the steel gears mentioned with short teeth have been giving most excellent satisfaction. They are practically noiseless in their operation and show but little signs of wear, proving that it is not detrimental to have fewer teeth in contact, as is the natural result from short teeth. The advantage in the short tooth is its great

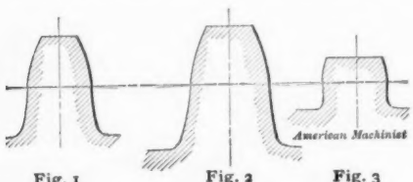

Fig. 1 55 T. 6" P. .75 L. of T. Fig. 2 50 T. 7½" P. .75 L. of T. Fig. 3 62 T. 6" P. .4 L. of T.

SHORT GEAR TEETH.

strength, the strength of the tooth being directly in proportion; hence, in long teeth we get more of them in contact, but at the expense of a greater leverage from the base of tooth to the points of contact. For special purposes of slow running gearing with great tooth stress, I should prefer a length of tooth as noted in this case, equal to .4 of pitch, and for general work a length of tooth of .6 of the pitch.

JOHN WALKER.

Chicago, Ill.

[In the cable power house of the Chicago City Railway Company, engines No. 1 and 2 have cylinders 30 inches diameter and 60 inches stroke, running 60 revolutions per minute. In August, 1887, two spur gears, with 43 teeth, each gear 18 inches face and 6 inches pitch, were placed on the crank shaft, with the teeth staggered, forming a gear 36 inches wide. Two spur gears, of 61 teeth, with teeth to correspond, were placed on the line shaft. The gears were of cast iron with strong oval arms. The two parts forming the pinion and the two parts forming the gear were bolted together at eight points of the rim. The teeth of these gears were as shown in Fig. 1. The gears were calculated to safely transmit 1,500 horsepower. They ran eighteen months, when the arms of the large gear broke. Then new cast-iron gears, each 20 inches face and 7½ inches pitch, with very heavy arms, took their place. They were built similar to the first pair; that is, each gear being 20 inches face, they together formed a gear of 40 inches face, with staggered teeth. The gears on the line shaft were, for reasons not mentioned, renewed in 1892. These ran about eighteen months, when a tooth broke out of one, and the other split through the rim. The teeth of these gears were as shown in Fig. 2.

After this experience it was decided to use steel gears, and a contract was made for them January, 1895. The pinions have 42 teeth, 20 inches face and 6 inches pitch, with staggered teeth, making 40 inches face. The steel gears that run with them have 62 teeth. These gears have machined joints; the holes are bored and reamed; all bolts are turned to fit the holes tight; the teeth are carefully cut, and the parts are bolted together transversely. The form and proportion of these teeth are shown in Fig. 3, and they were suggested by Mr. John Walker, general manager of Fraser & Chalmers, who built the gears.

The above, which we reproduce, not strictly verbatim, appeared originally in the "Street Railway Journal" as an interesting detail of street railway operating experience. It will not escape the attention of our readers that the record is not in itself conclusive upon the one point of the proper length of gear teeth. The last gears that were put in, having the short teeth, seemed to have been more carefully fitted than the others; and being also of steel, instead of cast iron, they must, upon that account also, have been stronger, independently of the proportions of the teeth. The very significant fact, however, remains that so high mechanical authority, and the most extensive experience in this special line, deliberately dictated the short teeth as the best to use under the very trying conditions, and that the record, as far as it goes, fully confirms the wisdom of the decision.—Ed.]

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Planer Finishing Tools.

Editor American Machinist:

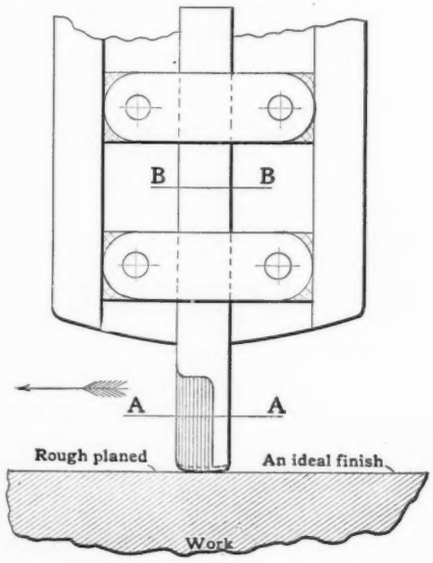
The accompanying drawing will make clear to the reader this—not generally known—finishing tool, and its helical rolled chip of steel or wrought iron. I first saw it in use at the Niles Tool Works, and learned that it was arrived at after several experiments made, a few years ago, by the planer foreman, who has received many inquiries for sketch. Its cutting action is perfect, as shown by inclosed chips from heavy and light finishing cuts. It works well without the aid of a lubricator or cutting solution; solving the problem of finishing such difficult metals—usually very trying to a planer hand. Enquirer "Junius," of January 21st, will find this of interest in his "doing things better."

About finishing tools, it may be well to add that at the same works they have these tools for use on planer tables and similar large surfaces, having a cutting face of three inches, giving a very wide finishing cut, and a chip that rolls itself "spirally" several turns. A sample generally finds its way to the tool chest, as a curiosity and to give support to the story. Those who have been accustomed to fine machine feed finish have looked with surprise on the ¼ to a 2 crank-turn finish feed.

Wide-face Mushet steel tools are used in reducing to size between the one roughing and the final finishing cut; using for this last a tool which has received almost the care of a razor in its preparation for the work.

WM. PILTON.

Hamilton, O.



A "SHEAR TOOL" FOR FINISHING STEEL AND IRON FORGINGS.

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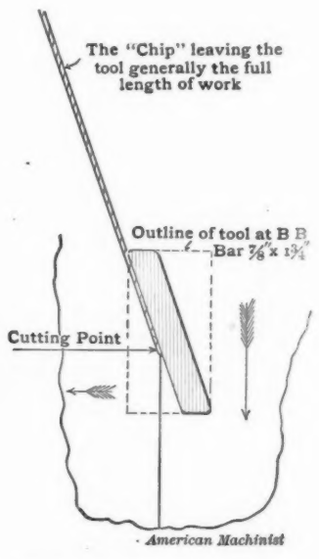
A "German" Calculating Machine.

Editor American Machinist:

The remarks by "Hudson" on "German Machine Copying" are well applied. I can cite a most flagrant case of the kind:

Some twenty years ago an American inventor, by the name of Baldwin, invented and attempted to introduce a calculating machine, or "arithmometer," for


The "Chip" leaving the tool generally the full length of work
Outline of tool at B B
Bar ⅞" x 1¾"
Cutting Point
American Machinist

PLAN SECTION AT A A.

common multiplication, division, etc., but had to give it up because there was then no market for such things in this country. Now, however, when we are catching up with European nations (some imagine that European nations are always catching up with us), and beginning to understand the calculating machine as a labor-saving appliance, a German manufacturer is making a most complete imitation of the Baldwin invention, and sending it over to us as of German invention. They not only do not state that it is of American origin, but they do positively state that it is of German invention. They have a United States patent, but it is on fussy details of no importance whatever, the gist and real substance being a clear steal from Baldwin.

GEORGE B. GRANT.

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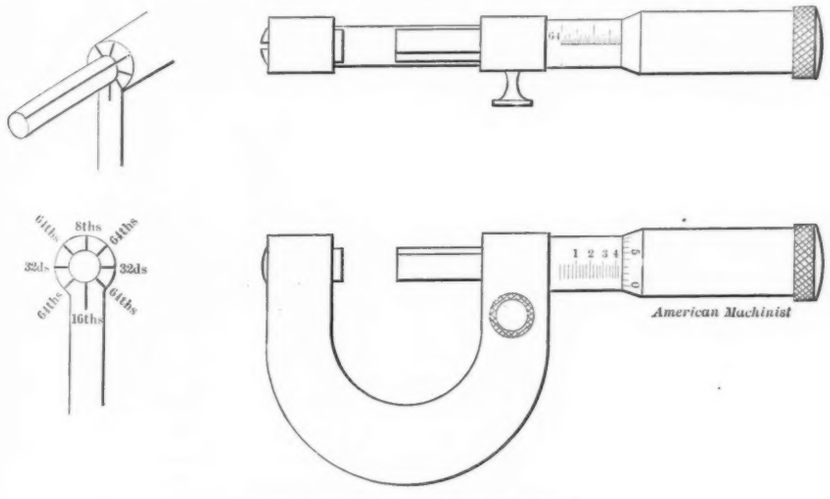
Micrometer Graduations.

Editor American Machinist:

The improvement in micrometer graduations described in the issue of January 14th brings to light a sketch designed by me for a similar purpose, some two years since, which perhaps goes a step farther than the one described, in enabling anyone to set the ordinary micrometer accurately, not only to thirty-seconds, but to sixty-fourths of an inch. The ordinary instrument, loaded down as it is with tables of decimal equivalents, would seem to be quite complete; still, there exists a chance for personal error which the various fractional and vernier devices do not entirely remove. Yet all these devices tend toward perfection, and it may be that still another addition will be received with resignation.



MICROMETER GRADUATIONS.

The sketch shows a line extending along the length of the spindle, together with eight radiating lines on the head from which the spindle projects; also a scale of sixty-fourths of an inch along the top of the barrel. When the micrometer stands at zero, or at any eighth of an inch division, the spindle line coincides with the top vertical line on the head. When measuring sixteenths it coincides with the lower vertical, thirty-seconds when coinciding with the horizontals, and sixty-fourths when coinciding with the 45-degree lines. When it is desired, as is frequently the case, to know the next nearest sixty-fourth to a given number of thousandths, the micrometer is set in the usual way to the desired thousandth, and the thimble is then further rotated, regardless of its circular divisions, until the next sixty-fourth of the scale of sixty-fourths coinciding with the bevel edge of the thimble, is observed. Suppose, on the other hand, it is desired to set the instrument to $\frac{29}{64}$ inch exactly : $\frac{29}{64} = .453125$ inch, Now, here is a case which the ordinary ten thousandth vernier attachment does not wholly cover, and a certain amount of estimating must necessarily be done under ordinary circumstances.

The bevel edge of the thimble is brought to coincide with the desired sixty-fourth on the scale of sixty-fourths, and the spindle line is brought to coincide with the nearest 45-degree line; or we set the instrument to the ordinary decimal equivalent, and then bring the spindle line to coincide with the 45-degree line, which is necessarily close by. It may be remarked that wear would not necessarily impair the accuracy of the instrument, because the front plug can be reset to compensate it.

CHARLES H. MCCLELLAN.

New Haven, Conn.

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A Haunted Scale.

Editor American Machinist:

"Talk about the total depravity of inanimate things," said old Jock, as the men were gathered about the boiler room during the noon hour. "I have had experience in repairing all kinds of machinery, but I can't cast out devils nor perform miracles."

At this some of the men began to look wonderingly at him, and someone ventured to ask him what he meant. "Well," he said, "I have been at work for two days on that scale which has just been put into the floor of the iron room, and the blamed thing is haunted." "How haunted?" asked one. "Does it walk about at night and clank its chains?" "Not exactly that," said Jock, "but it won't weigh correctly after dark, although it appears all right during the day." As the men appeared incredulous, he continued: "Now, fellows, we have just time to go out this noon and weigh ourselves, and then we will try it again after dark, and I think you will be as greatly puzzled as I am." The scale was a new one of the best modern construction, of 6 tons capacity, with the platform sunk flush with the top of the floor, the room below being vacant. The iron house was in charge of a competent man, and the iron was given out on a careful system of orders, so there seemed little chance to "monkey" with the scale. The men went in and examined and tested the scale to their satisfaction, and each man's weight was recorded by the ironmaster. Being in the late fall, it became quite dark before six o'clock, to the gratification of the men, who eagerly proceeded to the iron room to test their weights on the scale. Many were the jokes and gibes which were made on their way, but great was their surprise, when they reached the scale, to learn that each man weighed apparently about 30 pounds more than he did at noon!

It was the general opinion, however, that the scale had been tampered with in some way, and none of the men were quite satisfied. The next day each man kept watch over his neighbor, and all were agreed that no one of them could have done anything to the scale. Each man's weight at noon was about as before, and at night each showed about 50 pounds excess weight! Why should the scale show 30 pounds too much one night, and 50 pounds extra the next? Haunted, indeed! How much does a ghost weigh, and do two of them weigh more than one? However, the men were not to be fooled; they shook the scale; they ran a strip of steel all around the cracks at the edge of the platform, to make sure no stone or loose piece had fallen in, and finally, one of them borrowed a lantern and went into the room below, and the mystery was solved. Neighbor Whitney's hens had found their way into the open basement, and, after the fashion of chickens and curses, had gone to roost.

Now, the levers of the scale multiplied some twenty-five times, and a chicken of moderate weight, roosting towards the tip end, would be the equal of a whole flock upon the platform, and the cockerel, who had often imagined himself as big as an ostrich, had for once been taken at his own appraisal.

W. H. SARGENT.

St. Johnsbury, Vt.

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What is a Draftsman?

The debate on "School vs. Shop Draftsmen" has been so extended that there may be little attractive flavor to any further remarks. It seems to us that correspondence on the subject has left us just where we began, and, in fact, where we might as well conclude to stay. Nobody has yet improved upon the comedian's definition of a mascot, and likewise, all attempts thus far tend to emphasize the fact that "a draftsman is a draftsman."

If to be a draftsman is to execute lines in proper projection, then shop experience cuts no figure. If to be a draftsman is to illustrate shop knowledge on paper, then theoretical mechanics and the sciences have no play. If to be a draftsman is to invent, then genius finds its scope, and few of us there are who have it. If to be a draftsman is to picture to uneducated eyes shapes and forms, as on Patent Office sheets, then the artist's eye and hand control the situation. There are men who are expert in one or more of these acquirements, who are yet lacking in the essentials of a good draftsman, who fall far short of what the business of our shops requires.

What, then, is the making of a draftsman? What is the attribute which employers expect when they advertise: "Wanted—A good draftsman, to take charge of work. None others need apply"? Do they care whether the applicant was educated at Cornell, Worcester, Boston, Hoboken, or Sheffield? Do they specify whether ability should have been acquired through the correspondence school, or by tireless delving over book and board after ten hours at the bench? One of the most successful draftsmen of our acquaintance was a college man, with little bench experience. Another equally successful man served his time as a machinist before making his reputation at the board. These cases are not exceptional ones. For every educated draftsman cited to prove one side of the argument, there can usually be found a good example to prove the contrary.

A draftsman is a draftsman. No college ever produced one. No bench or lathe or planer experience ever made one. The college man will tell you that his task has been a hard one, that his course of theory was rudely shattered in his early struggles to produce designs and drawings for the shop. The shop man will tell you that it was no sinecure to place himself in command of design, that it was not as easy as it looked from the shopman's view.

A man who sells machinery, and who has been a close observer in his travels, said not long since: "The successful man to-day, be he manufacturer, salesman, shopman, erector or draftsman, is the man who makes things go!" There is the essence of business in that remark. You may theorize, you may experiment, you may illustrate, you may promise; but your fate is the fate of your results. Your work must go. A draftsman, above all, is a man of results; his judgment is by results alone. His pictures must be alive; they must move; they must work for him; they must do what he says they will do; they must *go*. Ericsson, the foremost draftsman of his time, paid little attention to conventional form in his sketches and drawings. Plan and elevation were curiously mixed and transposed. But they were true; they had life; they had "go" in them; their master put it there. They accomplished results.

It is the systematic looking ahead; the planning; the habit of thinking in a business way; the making of simple drawings; the use of "short cuts"; the omission of every bit of unnecessary work; the habit of subordinating all to the one idea of results—these are what make the man. This is what the employer means when he advertises for a "good man," although, perhaps, he himself does not realize it.

Such draftsmen are not merely ideal; nearly every shop which is up to the times has one or more such men. Neither are they infallible; they are subject to error like other men. But they are men of results; they are draftsmen—mechanical engineers, if you please; they possess something more than any school training can give them, or any manual expertness can produce. Some of us seek a lifetime for this "something" and never find it.

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A Hindrance to Foreign Trade.

The Gisholt Machine Company, of Madison, Wis., has been sending a good many of its tool-grinders abroad, and is successfully competing in foreign markets with copies of its own machine made in the countries to which it exports—underselling the foreign-made copy on its own ground.

They also have been sending abroad a good many turret machines, and frequently these are specially arranged and equipped with tools for finishing some certain casting, or castings. In order to test such a machine and its tools before shipment, they tried to get from their foreign customers a set of rough castings to be finished. They found that, in practice, it took from one to two months to get a set of these castings through the custom house, and that they had to pay the regular import duty upon them, notwithstanding the fact that they were to be shipped right back with the completed machine.

Of course, all this was not submitted to without protest. We do not know in detail just what was done in the effort to secure some modification of this burdensome condition of affairs, but we are informed that some American makers of bicycle hub forming and other cycle-making machine tools have had similar difficulties in obtaining samples of pieces to be made, forgings, etc.

These things have caused considerable annoyance and delay in filling foreign orders for machinery, and we think it must be conceded that machinery builders are entirely within the bounds of reason when they insist that our tariff laws should at least not interfere with the foreign business, which for the past year or two has been, in some lines of work, the main dependence to keep the wheels turning and the men employed.

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United States Consul Connelly, at Hiogo, Japan, in a communication to the State Department, gives some astonishing figures as to the advances in wages in Japan since the war with China. Agricultural wages have increased in the last year from .10 yen to .25 yen, or 150 per cent.; weavers, 125 per cent.; tailors, 100 per cent.; papermakers, fishermen, blacksmiths, about 100 per cent. There is great activity in the cotton-spinning in-

dustry, and the labor demand exceeds the supply at any price. Consul Connelly urges American manufacturers to exhibit at the Osaka Commercial Museum. All labor-saving machinery and notions should be patented in Japan before exhibiting.

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On the 20th of June, what is expected to be an important exhibition of manufactures, machinery, etc., will be opened in the exhibition building, Prince Alfred Park, Sydney, New South Wales. The exhibition will be open during the months of July and August, and those who are interested, and may wish to secure further information regarding exhibits, etc., may obtain it by addressing Mr. Edward Noyes, care of Standard Air Brake Co., 100 Broadway, N. Y.

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At this writing it does not seem to be known just how fast the new torpedo boat, the "Farragut," can move through the water. Each time she is speeded she seems to make a little higher record than previously made, and her last performance seems to have been at the rate of nearly thirty knots. This run was made on the Potomac river, with a party of government officials on board, and it is stated that the engines were not worked to their full capacity.

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What seems to have been a very disastrous boiler explosion occured at New Bedford, Mass., on the 27th ult. A boiler in the Acushnet mills exploded, wrecked some portions of the building, killed two persons, and inflicted considerable loss. A portion of the boiler was thrown a quarter of a mile from the scene of the explosion, and wrecked a police station.

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Edward Ellis, president of the Schenectady Locomotive Works, Schenectady, N. Y., died at his home in Schenectady, at the age of 53 years, on the 28th ult.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(31) F. N., Pemberton, N. J., asks if steel castings shrink the same as iron castings. He had occasion to make a pattern for a two-throw crank shaft, 6 feet long, and the casting came out fully as long as the pattern. A.—There seems to be no regularity in the shrinkage of steel castings when made at different steel works, though we have never before personally known of a case without any shrinkage. Some, perhaps most, of the steel works call for a shrinkage double that for cast iron, with an allowance of $\frac{3}{8}$ inch for all surfaces to be finished. The steel-maker who is to make the casting, should be consulted in all cases before the pattern is made.

(32) G. F., Erie, Pa., asks: What is the nature of the service for which the red indurated fibre used in thrust bearings is best suited? I notice it used in drill press spindles, and but one thickness is used. Would it be good practice to use two thicknesses, one secured to the sleeve and the other fastened to the spindle? A.—We do not think that this material is adapted to run together, that is where two washers each made of the same material would work in contact with each other. The fibre works well while in contact with steel or iron, and probably other metals. We do not know all the purposes for which this material is used, but the makers of it will give you information on this point. The use of vulcanized fiber is more common for this purpose.

(33) W. S. S., Ramer, Ala., asks: 1, What feed per revolution would you recommend for 12-inch or 18-inch width of cut on yellow pine, 44 inches to 54 inches saw and 20 horse-power engine? A.—Probably from $\frac{1}{8}$ inch to $\frac{1}{4}$ inch. If you can see any saw doing that work anywhere, you can learn more from that than you can from us. 2, What width of face and what material would you recommend for 18-inch disk, 10-inch or 12-inch diameter wheel (used on some wood-working machines and, I believe, on some of the W. F. & John Barnes machines)? A.—Here again the actual machine should be able to give the better answer. If we understand the question, it refers to a variable feed produced by a flat disk driving the face of a wheel at right angles to it, the latter being movable either way in the direction of the disk radius for changing the speed. If we are correct in our assumption, we would say that the driven wheel is relatively larger in diameter than we have usually seen used. We would cover the driving disk with sole leather, and make the face of the driven wheel not over two inches wide. Would make it narrower, if the power required of it was light. 3, What has become of the Kane Pennington motor you told us about some time ago? A.—The motor was recently booming in England; we have not heard much of it very recently.

(34) "Chicago," Cincinnati, O., asks: 1, What pitches, if any, are the standard adopted for riveting by the Am. B. Mfg. Assoc.? A.—We are not informed of the adoption of any such standard. 2, If there is no such standard, what are the best pitches, under the following data, for both single and double riveting? A.—We give the data of our correspondent, comprising in each case the first three items, with the additional particulars called for, all in inches or parts of inches.

SINGLE RIVETED LAP JOINTS.

Thickness of Plate.	Diameter of Rivet.	Diameter of Hole.	Center of Rivet to Edge of Plate.	Center to Center of Rivets.
$\frac{1}{4}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{7}{8}$	$1\frac{1}{2}$
$\frac{5}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	1	$1\frac{3}{4}$
$\frac{3}{8}$	$\frac{3}{4}$	$\frac{13}{16}$	$1\frac{3}{16}$	2

DOUBLE RIVETED LAP JOINTS.

Thickness of Plate.	Diameter of Rivet.	Diameter of Hole.	Center of Rivet to Edge of Plate.	Between Rows of Rivets.	Center to Center of Rivets.
$\frac{1}{4}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{7}{8}$	$1\frac{7}{16}$	$1\frac{3}{4}$
$\frac{5}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	1	$1\frac{1}{8}$	2
$\frac{3}{8}$	$\frac{3}{4}$	$\frac{13}{16}$	$1\frac{3}{16}$	$1\frac{3}{4}$	$2\frac{1}{2}$

(35) E. R. P., Montpelier, Vt., asks for the derivation of the formulæ for M_b and f_{bc} in Mr. Lewis' article on the "Strength of Hoisting Drums," which appeared in our issue for February 11th. A.—The formula for M_b is the standard formula for the strength of a hollow round beam under bending stress. By referring to Kent's Pocket Book, page 268, you will find that the moment of resistance for a beam loaded in the middle and supported at both ends is $\frac{R\,I}{c}$, in which

R = stress per square inch of extreme fibre;
= f_{bc} in the notation used by Mr. Lewis;
I = moment of inertia.
c = distance from neutral axis to extreme fibre;
= $\frac{1}{2}\,D$ in the notation used by Mr. Lewis.

Using the notation of Mr. Lewis, the formula becomes:

$$\frac{f_{bc}\,I}{\frac{D}{2}}$$

On page 249 of the pocket book, we find that the moment of inertia for a hollow round beam is:

$$I = \frac{A\,D^2 - a\,d^2}{16}$$

in which

A = area of outer circle;
D = diameter of outer circle;
a = area of inner circle;
d = diameter of inner circle.

Introducing the values of A and a, the formula becomes:

$$I = \frac{(D^4 - d^4)\,\frac{\pi}{4}}{16}$$

and we have:

$$\text{Resisting moment} = \frac{2\,(D^4 - d^4)\,\frac{\pi}{4}}{16\,D} f_{bc}$$

$$= .0982\,\frac{D^4 - d^4}{D}\,f_{bc}$$

Placing this resisting moment equal to the bending moment, we have the formula for M_b, as given by Mr. Lewis. The formula for f_{bc} is the same thing transposed.

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The fastest time between Jersey City and Washington, was made by the train which conveyed Vice-President Hobart and party to the inauguration. The train ran over what is known as the Bound Brook route, which is composed in part of the Central Railroad of New Jersey, Philadelphia & Reading, and the Baltimore & Ohio. The total weight of the train was about 200 tons, and it was first pulled by engine 458 of the Jersey Central, from Jersey City to Philadelphia. The train left Jersey City three minutes later than the schedule time, and on leaving Trenton Junction, the first stopping place, it was five minutes behind the schedule, four minutes of which time was made up between Trenton Junction and Philadelphia. At this point, Baltimore & Ohio engine No. 1313, took the train and pulled it the rest of the distance, leaving Philadelphia 7 minutes behind the scheduled time. This time was made up, however, between Philadelphia and Washington, at which place the train arrived 7 minutes ahead of the

schedule time, which had been intended for 4 hours 30 minutes. The run from Baltimore to Washington, 40 miles, was made in 36 minutes, the fastest time ever made for that distance, and the total running time between Jersey City and Washington was 4 hours 8 minutes. Making deductions for stops and slow orders, the average running time for the entire distance was 60 miles per hour. The first 57 miles out of Philadelphia were covered in 56 minutes, and at one point between Baltimore and Washington a distance of $8\frac{1}{10}$ miles, was covered in 6 minutes, an average of about 81 miles per hour, and for another distance of $18\frac{7}{10}$ miles the average speed was 75 miles per hour.

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We have a private letter from John J. Grant who for some time past has been in France, and in which letter he states that, as a result of some seven months' work in introducing American machine tools, especially automatic screw machines, about $600,000 worth of American machinery has been sold in England, France and Germany. He states that the foreign patents for ball making machinery have been sold to the Deutsch-Waffen-Munitionfabric, Berlin, Germany, and they will put in a plant capable of producing twice as many balls as can be produced in any other in the world. This machinery is being made by the Cleveland Machine Screw Company, and is expected to be ready for operation some time this summer. There will be about 500 machines in the lot, and this German concern undoubtedly is to be congratulated on obtaining the patents and technical knowledge of the Grant system, a description of which appeared in our issue of Oct. 1st, 1896.

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What seems to be a combination of a strike and lock out has taken place at the Globe Iron Works, Cleveland, O., where a part of the force having gone on strike, the managers decided to close and throw all the men out of employment until the difficulty may be settled.

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A new technical monthly, the "Revue de Méchanique," published in Paris, began its existence with the January number. Among our innumerable engineering contemporaries, it will, if it proves to be all that of which the first issue gives promise, occupy a place above the average in point of merit. In scope, it is a magazine rather than a newspaper; in treatment, it is scientific rather than superficial. It is under the supervision of a distinguished corps of editors, with Haton de la Goupillière, president, and Gustave Richard, secretary. The intention is to publish in each number, first, one or more weighty original articles, theoretical, experimental, etc; second, reviews upon various branches of machinery, each by a special editor; third, a chronicle of bibliography, news, etc. A list of the leading articles in the January number will show the nature of the contents and of the contributors: "Determination of Fundamental Data in Testing Steam Engines," by Dwelshauvers-Dery; "The Eutropic Diagram," by J. Boulvin; "Compound Locomotives," by Edouard Sauvage; "Refrigerating Machines," by Gustave Richard; "Gas and Petroleum Motors," by the same.

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A New Ruling Pen.

Theodore Alteneder & Sons, of Philadelphia, send us a beautifully finished ruling pen, which is so arranged that it can be readily cleaned without changing the adjustment for width of line. The manner of doing this is shown by the accompanying engraving, and it is to be

NEW RULING PEN.

noted that when in use the pen is practically the same as a plain one. Another improvement is in what may be called a friction device for the screw. This consists of a small plate through which the screw is tapped and which is split through the tapped hole and has sufficient tendency to close on the screw and keep it always close and make it work smoothly and evenly without looseness.

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The First Side-Planing Machine.

Editor American Machinist:

We notice in your number for the 31st December, last year, an article on side-planing machines, which we beg to complete by mentioning that the first side-planing machine built, and to which you refer was constructed by the late Mr. C. G. Bolinder, one of the founders of our firm.

For J. & C. G. BOLINDERS,
Mekaniska Verkstads Aktie-Bolag.
Stockholm, Sweden. Irik Aug. Bolinder.

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W. L. Cheney, of Meriden, Conn., referring to our answer regarding methods of distinguishing the figures 6 and 9 when stamped on tools, wishes to know what is the matter with making the stamps like these figures as they are usually written with pen and pencil, in which form they are readily distinguishable from each other, no matter which side up they may happen to be. He states that this scheme has been used in the Pratt & Whitney shops for years, and it would seem as though it ought to work well.

Mrs. E. A. Stevens, widow of the founder of Stevens Institute, has transferred to the Trustees two large lots and houses directly adjacent to the Institute grounds, which, while having at present a valuation of about $30,000, have a prospective value many times as great.

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Commercial Review.

NEW YORK, SATURDAY EVENING, MARCH 6TH.

DYNAMOS AND MOTORS.

A certain tradesman, engaged in a line quite foreign to electricity, says that yesterday people coming into his office were wont to ask, "How do you find business to-day? Better than it has been?" To which the reply was, "No; it isn't." "Well," the interlocutor would rejoin, "it ought to be, now we have a new President." It is our purpose here to treat of the electrical machinery market, irrespective of presidents, good or bad.

The atmosphere, undertone, or whatever it may be called, of this branch of business, does not impress one as utterly demoralized. In fact, we have definite information that the works of several important concerns are well employed. A recently received letter from the Crocker-Wheeler Company, for instance, alludes to the fact that they are rushed with work. Also, the one concern capitalized at fifty millions of dollars is fortunate enough to be kept satisfactorily employed, the magnitude of the operations involved in this case necessarily increasing the significance of such a statement.

Although February was not a month of heavy sales in electrical machinery, as a general rule, there are indications that the trend of business is now upward. More than one house reports a marked change during the last two weeks. One of them, the C. & C. Electric Company, mention, as a little sign of promise, the sale, in this city, within about the length of time alluded to, of some 250 horse-power of motors of five or ten horse-power each, to be run on Edison circuits. It appears from this as if factories, etc., were more willing to spend money. The motor business, some find to be relatively more active at the present time than that in dynamos, but the attitude of the latter is rather favorable because of the number of city office buildings the letting of whose lighting goods contracts is being awaited. The orders are, indeed, a little slow about appearing. One, recently closed, was that of the Queen Insurance Company's building, which fell to the Walker Company. Never before, it is said, was the tendency so marked as now, to adopt the isolated-plant system for the lighting of buildings, rather than to take the current from the street circuits.

In street railway work, the past four weeks have not been characterized by the placing of many large contracts, but the tone of business in a smaller way is some-

what more healthy. More extensive developments may be looked for a little later.

THE EXPORT FIELD

for electrical machinery is reported by companies who supply street railway equipments to be good in Europe; the South of Europe being especially called attention to by one authority. In response to queries regarding Spanish-American trade, it is common to hear the admission that orders are not at present coming in heavily.

An engineer who has been representing an American electrical company abroad for a year and a half says, that while our manufacturers have been exporting electrical goods to South America and Japan, and somewhat, also, to Southern Europe, the North of Europe, including Denmark, Sweden, Norway, Finland and Russia, has been neglected. These countries, which are now dependent principally upon Germany or England, he considers, would be a profitable field for American electrical manufacturers. He thinks, moreover, that we are too largely in the habit of allowing our exports to pass through the medium of English or German houses.

The Fort Wayne Electric Corporation are executing a contract for an electric light plant in Curacoa, D. W. I. A project connected with the plant is the sinking of a 700-foot cable.

The C. & C. Electric Company reports having sold during the last couple of weeks a 20, a 40 and a 60 kilowatt dynamo, for plantation purposes in Mexico and elsewhere.

In Japan are to be established new street railways, involving a capital of about $3,500,000, and likely to afford an opportunity for American manufacturers to furnish materials and rolling stock. They comprise the Fushimi Electric Railway's proposed lines, of about 30 miles in extent, promoted by Okubo Yoskio, of Tokio; and a 44⅓ mile line to be built by the Tokio Circuit Tramway.

Here are some chances for foreign business. A tunnel is to be constructed under the Straits of Messina, from Italy to Sicily. Plans and requirements will be sent to this country as early as to England or Germany, for the benefit of our machinery contractors, etc. Parties from Peru will reach New York by the end of March, to buy mining machinery. There is a prospective increase in demand for railway material, electric light plants and machinery in Colombia.

The Buffalo Forge Co. who have just gotten out a catalogue of blacksmiths' tools in Spanish, for Mexican trade, write, "The foreign field has proven so profitable, even in the old European countries, that we anticipate our export business will soon surpass the home trade."

We have just received word from G. F. Danielson, manager of The Toledo Machine & Tool Company, Toledo, O., that they have closed contracts with Selig, Sonnenthal & Co., No. 85 Queen Victoria street, London, E. C., to represent them as their European agents for the Eastern Continent, and that they are now preparing to ship them a car load of their latest improved power punches and presses, such as are especially adapted to the bicycle trade, sewing machine, typewriter, cash register, agricultural implements, etc., and all European inquiries for their product should be referred to the above named firm. They also report that they are now very busy, having really more orders on hand than at any one time heretofore since they began business, and the outlook for the future is very promising.

As a light upon trade in certain sections of this country, the Davis & Egan Machine Tool Company, of Cincinnati, report having just received some orders from the South and Southwest: to wit, from the Birmingham Machine & Foundry Company, Ala.; the Alamo Iron Works, San Antonio, Texas; the F. M. Davis Iron Works, Denver, Col.; and from Louisville, Ky. They note a good run of inquiries from the South, but that elsewhere everything seems quiet.

Our summation of the items of machinery, so far as distinguishable, in the manifests of cargoes foreign-bound from the port of New York, made public during the week ending March 6th, gives a total of $508,000.

We would refresh the minds of our readers concerning the fact that an exposition of some international importance is to be held this year in Brussels, Belgium, and that it appears to offer an excellent opportunity for those machinery manufacturers who are aggressively disposed, to show the world what they are capable of constructing.

PITTSBURG REPORT FOR FEBRUARY.

Trade conditions are becoming more active in all lines, and prices are steadily advancing on raw and finished products. The spring trade is in full activity, and very large operations will be the rule from now on. The main thing which has stirred up business was the steel rail war, which was brief, but extremely fierce, and the execution was all that could be desired. Prices of rails were cut enough to satisfy buyers that there was nothing left for them but to contract for all that their needs required, within the limit of their credit. It is estimated that about $20,000,000 worth of rail orders were placed on the books of the members of the late pool within five days, which is equal to 1,100,000 tons.

One interesting feature of the raw-product market, is the firmer price for billets and for Bessemer pig. With the mills busy on rails, the production of billets will be lessened, and prices may be expected to work toward a paying basis. In Bessemer pig, sales have been made extending well into the summer. Prices of nearly all products, outside of Bessemer pig and billets, approach the end of February on the low level of many weeks past.

More iron is being melted in the numerous foundries of this district, and the feeling is much improved. The demand for castings of all kinds is gradually increasing, and the only thing still left to the future is better prices. This has been the complaint more than anything else. The

(*Continued on page 36.*)

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Send $1 to the Tabor Mfg. Co., Elizabeth, N. J., for improved stop-motion revolution counter.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

A mech. eng., grad. of a Ger. univ., good math. and d'ftsman, wishes pos.; mod. salary. Ad. M. S.

Mach. draftsman wants situation; long experience; good ability; mod. sal. Box 117, Am. Mach.

Tracer and detail draughtsman, three years' experience in car and locomotive works. Box 113, American Machinist.

Mechanical draftsman, 25, expert designer of automatic machinery, desires steady position town or country. Box 112, American Machinist.

A first-class mechanical engineer wants position, either as estimating or erecting engineer, d'ftsman or as a representative. Box 119, Am. Machinist.

Wanted—Pos. after April 1 by supt. of large hoisting and mining eng. works, either salesman or supt. large ex. in gen. mach. Ad. Box 118, Am. Mach.

Wanted—Position as gen. foreman or supt.; am thoroughly posted on get'g up spec. or gen. mach.; high speed steam or gas engs. Box 108, Am. Mach.

General machinist of 13 years' experience, foreman 2 years, desires permanent position where sobriety and attention are appreciated; no preference in work. P. O. Box 391, Marshalltown, Ia.

Mechanical engineer, 25 years exp. as d'ftsman, foreman and supt. on gen. and special mach. and buildings, wants suitable pos. Chicago preferred. Best ref. Box 1074, N. Francisco Av., Chicago.

Wanted—Position as foreman pattern maker; 34 years; now in charge; practical d'ftsman; exp. in hoisting and mfg. mach. and arch. work; west of Mo. River or Mexico preferred. Box 111, Am. Mach.

Gas Engines—Thorough all round machinist, 2 years with one of the best builders, will construct engines that in efficiency and design equal any on the market. Investigate, good thing. 109, Am. Mach.

Wanted—By April 1, position as superintendent or foreman of machine shop or engine works, by practical up to date man, familiar with gig and quick methods of doing work; 12 years' experience; A1 reference. Box 115, American Machinist.

A skilled designer and constructor with 25 years' exp. in labor saving and auto. mach. is open for engagement, or will undertake spec. work for mfrs. Unquestionable references from past and present employers and patrons. Ad. Box 71, Am. Mach.

Help Wanted.

Help Wanted—Good pay for leisure hours. Geo. W. Lord, Philadelphia, Pa.

Wanted—Superintendent for an established machine tool shop. Must be first-class man and competent to handle 150 men. Box 120, Am. Mach.

Engineers out of employment can make good com. by selling our new book The Practical Man. of Engines and Boilers. $2. Phila. Book Co., Phila., Pa.

Wanted—Number one foundry foreman, who understands melting iron and best way of getting out castings, modern shop. Pig Iron, Am. Mach.

Wanted—2 first-class machinists experienced in small and accurate work on tools, jigs and fine machinery; state age, experience and wages expected. Ad. New England, care Am. Machinist.

Wanted—Mach. or elec'n with small capital, to invest in well estab. good paying f'dry. mach. and m'f'r'g. bus. in thriving town, and take per. pos. at good salary. Address Box 114, Am. Machinist.

Wanted—An up to date f'ndry foreman on heavy, dry and green sand work; also small machine and arch. castings; thor. famil. with mixing irons and handling men to advantage; a good op'n'g for right man; state age, ex. and ref. Ad. 116, AM. MACH.

Wanted—A machinist and a boiler maker who can each invest $3,000 to $5,000 in a company doing a good foundry, machine and boiler business, located in Western New York, to take charge of machine and boiler departments. Box 103 AM. MACH.

Editor wanted for a leading steam engineering journal; must have technical and practical knowledge of this branch; prefer man with newspaper experience and acquaintance in the trade. Address in confidence, with full particulars and salary expected. Practical, Box 672, New York.

Wanted in Ohio—Thoroughly competent man to take charge of die department employing about 25 hands on general line of dies for sheet metals. None but those with executive ability and push, and thoroughly competent need apply. Address with full particulars as to experience, salary expected, etc. Box 110, AMERICAN MACHINIST.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Draftsmen's new conveniencies. D. J. Kelsey, New Haven, Conn.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., of Spring and Varick streets, New York City.

Wanted—The right party to build one special 6-spindle drilling lathe. Address for further particulars, "6-Spindle," care A. M. P. Co.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—Every reader of this paper to send 35 cents for The Tool Catalogue. See Montgomery's advertisement on page 1 of this edition.

Wanted—A second-hand bench-lathe with spring-chucks and slide-rest; state price and how long in use. Box 121, AMERICAN MACHINIST.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

Wanted—An active partn'r with $10,000 or $15,000, to take half interest in mfg. bus., estab. for 15 yrs. and now having a world-wide reputa. A thorough mechanic preferred. Exceptionally good inducements offered. Ad. Lock Box 805, Bridgeport, Conn.

MODERN WATCH FACTORY PRACTICE.

The Evolution of Automatic Machinery

By E. A. Marsh, Asst. Supt. Amer. Waltham Watch Co.

The Latest Mechanical Movements. A book rich in ideas for the Machinist. Silk cloth, gilt top, gold side and back stamps, 140 pp., enameled paper, 72 half-tone illustrations from photos taken for this work. Price $2.00 by mail, to any address in the world. Send for catalogue.

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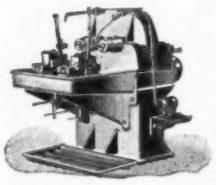

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Two Styles. Four Sizes.
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Webster & Perks Tool Co.
Cor. Spring and Monroe Sts.,
Springfield, Ohio.

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METAL-WORKING MACHINERY.
CATALOG E.

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A book designed for the general information of every one interested in this new and popular motive power, and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer.

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• • •

NORMAN W. HENLEY & CO.
PUBLISHERS,
15 Beekman Street, NEW YORK.

(Continued from page 35.)

output of many foundries has been increased greatly, while in some cases the working hours have been extended. The condition of this line of trade is of a recovering nature, and the prospects are that before long it will be healthy.

Machinery trade has also revived somewhat. One large dealer in general machinery advised the writer that his business for January and February was far in excess of that of the last five months of last year. Nearly every machine builder and dealer will tell you that there are plenty of inquiries going, and that there is not nearly as much trouble in having contracts closed as formerly. Another fact worthy of mention is that buyers do not bring prices down to the last cent, as was the case during the closing months of 1896.

As yet, the plans for improvements contemplated by many manufacturers have not been fully prepared, but these are, no doubt, being held back until some sign of the spring season appears, when ground can be easily broken.

Mill supply people are kept fairly well booked. The flood during the past week caused a great amount of damage to the many plants along the banks of the Allegheny, Monongahela and Ohio rivers, and will serve to give a temporary boom to the supply men.

The gist of the situation, as the month is closing, is an improvement, and while there is no sign of a boom, it is quite evident that things are assuming a more cheerful aspect.

Quotations.

NEW YORK, Monday, March 8.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ $12 50
No. 2 foundry, Northern	11 50 @ 11 75
No. 2 plain, Northern	10 75 @ 11 00
Gray Forge	10 50 @ 11 00
No. 1 foundry, Southern	11 50 @ 12 00
No. 2 foundry, Southern	10 75 @ 11 00
No. 3 foundry, Southern	10 25 @ 10 75
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 50 @ 10 75
Foundry forge, or No. 4 Southern	10 25 @ 10 50

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.25c. Store prices: Common, 1.40 @ 1.50c.; refined, 1.50 @ 1.60c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.60 @ 1.65c.

Cold Rolled Steel Shafting—Base size, 2.60 @ 2.65c., in small lots, from store.

Copper—Carload lots, Lake Superior ingot, 11⅞ @ 12c.; electrolytic, 11¾ @ 11¾c.; casting copper, 11¼ @ 11½c.

Pig Tin—For 5 and 10-ton lots, 13.50c., f.o.b.

Pig Lead—In carload lots, 3.42½ @ 3.45c., f. o. b.

Spelter—In carload lots, New York delivery, 4.10 @ 4.15c., f. o. b.

Antimony—Cookson's, 7¼ @ 7⅜c.; Hallett's, 6¾ @ 7c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 38 @ 40c.

▲ ▲ ▲

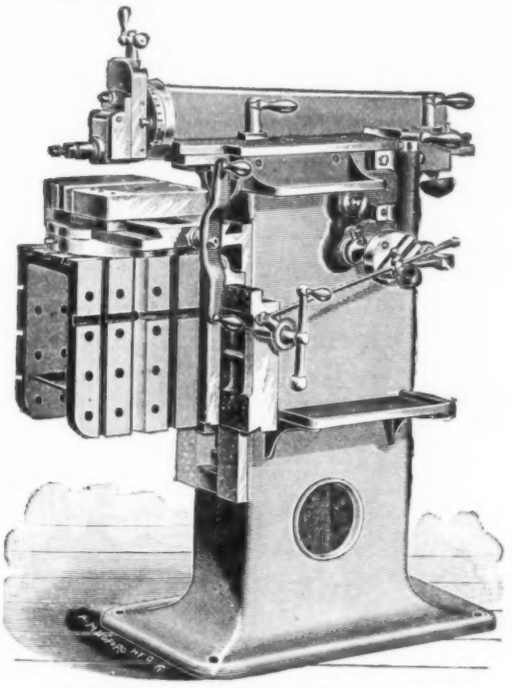
Manufactures.

At Poulan, Ga., J. H. Bromley will erect a cotton mill.

At Houston, Tex., D. M. Angle will install new machinery.

The town of Washington, La., will install an electric light plant.

(Continued on page 37.)



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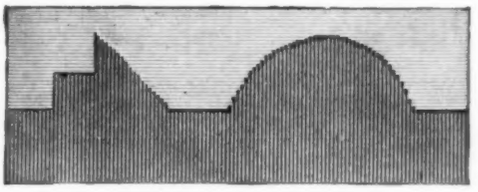

This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

▲ ▲ ▲ ▲

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(Continued from page 36.)

H. W. Palen's Sons, of Kingston, N. Y., will erect a new factory soon.

G. H. Lovell, of Dalton, Ga., intend to install an electric light plant.

The Horne-Payne Company will erect a concentrator at Lardeau, Wash.

Dent & Waterbury, Whitestone, N. Y., are erecting a mill at that place.

At Warren, Mass., the Warren Steam Pump Company has been organized.

A. J. Reach & Co., Philadelphia, Pa., are to add five stories to their factory.

At Watertown, Tenn., Messrs. Young & Moore will erect a soap factory.

The Buhl Steel Company, Limited, will soon erect a tin-plate mill at Sharon, Pa.

The G. P. Bamberg Company, Bamberg, S. C., will place new machine tools.

The Pennsylvania Water Company, Wilkinsburg, Pa., will erect a new engine house.

The flouring mill of W. H. Weaver, Pittsburg, Pa., was destroyed by fire recently.

The roller mill of W. H. Weaver, at Millheim, Pa., was recently destroyed by fire.

The Temple Foundry Company, of Temple, Tex., will move their plant to Taylor, Tex.

The Jackson Manufacturing Company, of Nashua, N. H., will install new machinery.

The Eagle Foundry Company, of West Belleville, Ill., will make an addition to its plant.

D. O. Cunningham & Co., of Pittsburg, contemplate the erection of a new glass factory.

The North American Chemical Company, Perth Amboy, N. J., will place new machinery.

The Hyde Steam Windlass Company, of Bangor, Me., will soon be in their new factory.

The Government Printing House at Washington, D. C., is to have new boilers installed.

The Barnes Bicycle Company, of Syracuse, N. Y., have had their plant destroyed by fire.

At Middlebranch, O., the Portland & Diamond Cement Works have been destroyed by fire.

The plant of the American Plate Glass Company, at Alexandria, Ind., will be rebuilt at once.

The plant of the American Plate Glass Company, at Alexandria, Ind., has been destroyed by fire.

At Milwaukee, Wis., the Crow Stove Polish Company contemplate the erection of a new factory.

The Hibernia Brewing Company contemplates the erection of a $150,000 brewery at Wilmington, Del.

It is reported that the Lehigh Valley Railroad is planning to establish shops at South Plainfield, N. J.

The Sefton Manufacturing Company, of Chicago, Ill., contemplate the erection of a factory at Anderson, Ind.

The shops of the Newfoundland Northern Railroad Company, at Whitbourne, N. F., were recently destroyed by fire.

The Beaufort Knitting Mill Company has been incorporated by R. A. Long and George Holmes at Beaufort, N. C.

It is quite probable that the plant of the Paris Manufacturing Company, South Paris, Me., may enlarge its plant.

At Gallipolis, O., C. H. D. Summers has bought the Lindle mill, which he will repair and place new machinery in.

At Taunton, Mass., a new power station will be erected by the Brockton, Bridgewater & Taunton Street Railway Company.

The Koepp Gear Wheel and Foundry Company, Pittsburg, Pa., whose plant has been recently destroyed by fire, will rebuild.

At Cohoes, N. Y., the Cohoes Iron Foundry

& Machine Company has been organized. David S. Johnson, of Cohoes, is interested.

The property of the J. H. McEwen Manufacturing Company, of Ridgway, Pa., has been sold to the Ridgway Dynamo & Engine Company.

The Henry Roos Foundry Company has been incorporated at Chicago, Ill. Incorporators: Henry Roos, Mathias Hank and Louis Baumgartner.

The Quincy Mining Company, of Houghton, Mich., is contemplating the erection of a smelting plant of its own, to be located at Torch Lake.

The Davis & Egan Machine Tool Company, of Cincinnati, have just received a large order from Stockholm, Sweden, for some forty machines, amounting to about $22,000; also a large order from Sheriff, Swingley & Co., of Johannesburg, South Africa.

The La Capital Company, of Buenos Ayres, Argentine Republic, South America, have let contract for the materials for a power station and the necessary equipment for the power in the station, and the road bed and cars, to parties in the United States. The Berlin Iron Bridge Company, of East Berlin, Conn., have the contract for furnishing the skeleton steelwork of the building and the roofs.

President Freeland and Secretary Robertson, of the American Bank Note Company, of New York, have been in Ottawa to sign the engraving contract with the Minister of Finance. They will ask permission from the United States authorities to take Canadians to their establishment in New York to instruct them there in the use of the machines, so that when they begin at Ottawa on July 1st they will have competent Canadian workmen. They will immediately proceed to put up a new building and put in the plant.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

We have received from H. G. Barr & Co., Worcester, Mass., a catalog containing illustrations and descriptions of cutter and reamer grinder. The catalog is 5¾ x 9¼ inches.

William Jessup & Sons, New York, N. Y., send us a catalog and price list. A brief account of the origin and subsequent development of this concern is also included. The catalog is 3½ x 5¾ inches.

We have received from the Ingersoll Milling Company, Rockford, Ill., a copy of catalog containing illustrations and descriptions of milling machines, boring and drilling machines, etc. The catalog is standard size, 6 x 9 inches, and will be sent to all interested in this class of machinery, upon application.

The General Electric Company send us a new catalog of electric pumping machinery, which describes a great variety of electrically driven pumps for mining, water supply and miscellaneous purposes. The catalog is fully illustrated with pictures of actual pumping plants, and will be a source of surprise to many as an indication of the extent to which electricity has been applied to this purpose. It is 8 x 10½ inches in size.

Montgomery & Co. send us a copy of their new bound and priced catalog of machinists' supplies and small tools of all kinds. No better illustration can be found of the magnitude of the machinist's vocation than the size of this book, dealing almost exclusively with what may be called the secondary equipment of shops, by which we mean the equipment apart from the line of machine tools which at first sight make up a shop's outfit—710 7½ x 10½-inch pages, with illustrations by the hundred.

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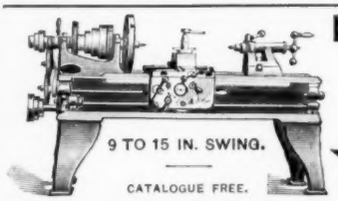

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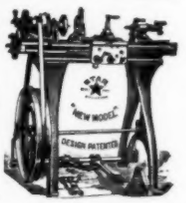

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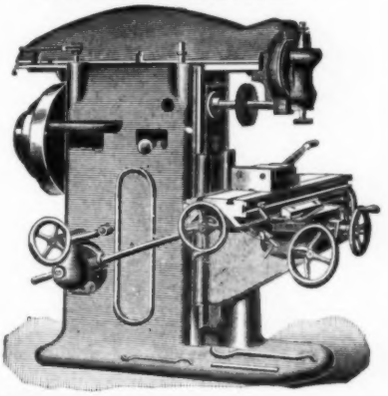

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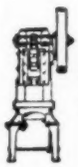

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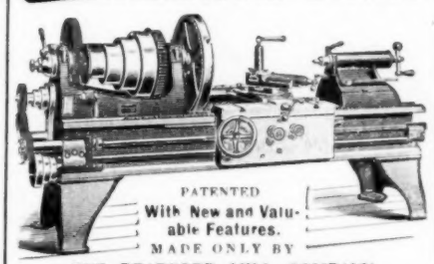

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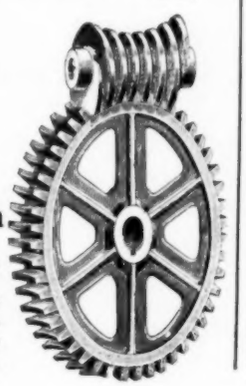

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Dixon Crucible Co., Joseph, Jersey City, N. J.

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BICYCLE TOOLS.
American Gas Furnace Co., New York.
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Pope Tube Co., Hartford, Conn.

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American Gas Furnace Co., New York.
Buffalo Forge Co., Buffalo, N. Y.
Roots Co., P. H. & F. M., Connersville, Ind.

BOILERS, STEAM.
Greenfield, W. G. & G., Newark, N. J.
Weston Engine Co., Painted Post, N. Y.

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Acme Machinery Co., Cleveland, O.
Davis & Egan Machine Tool Co., Cincinnati, O.
Detrick & Harvey Machine Co., Baltimore, Md.
Geometric Drill Co., New Haven, Conn.
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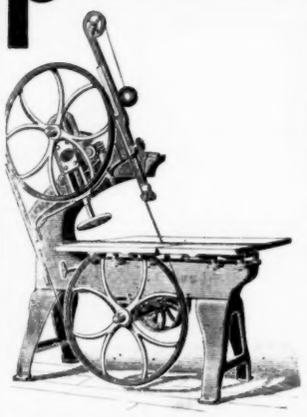

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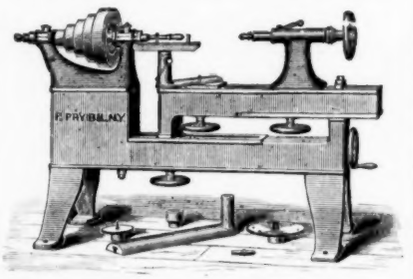

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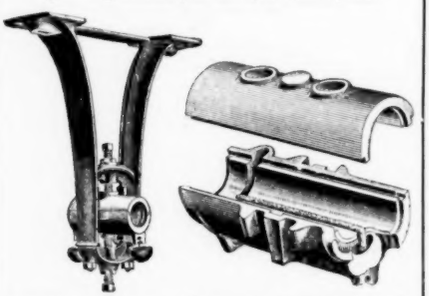

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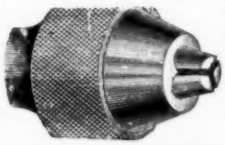
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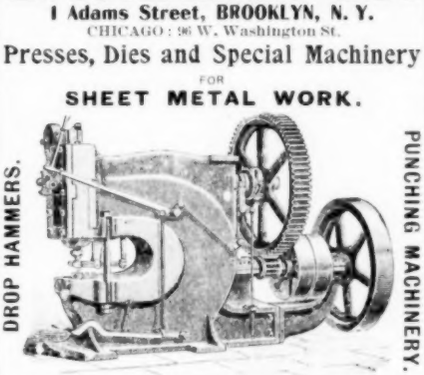
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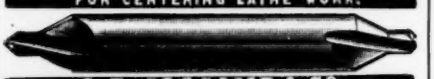

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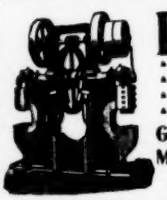

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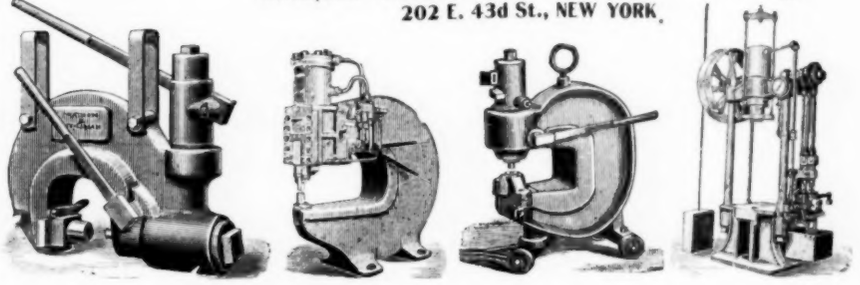

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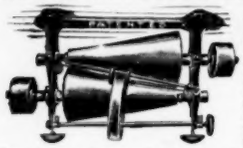

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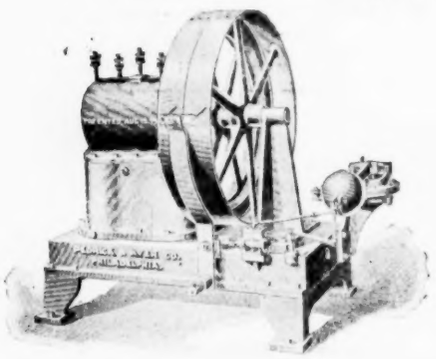

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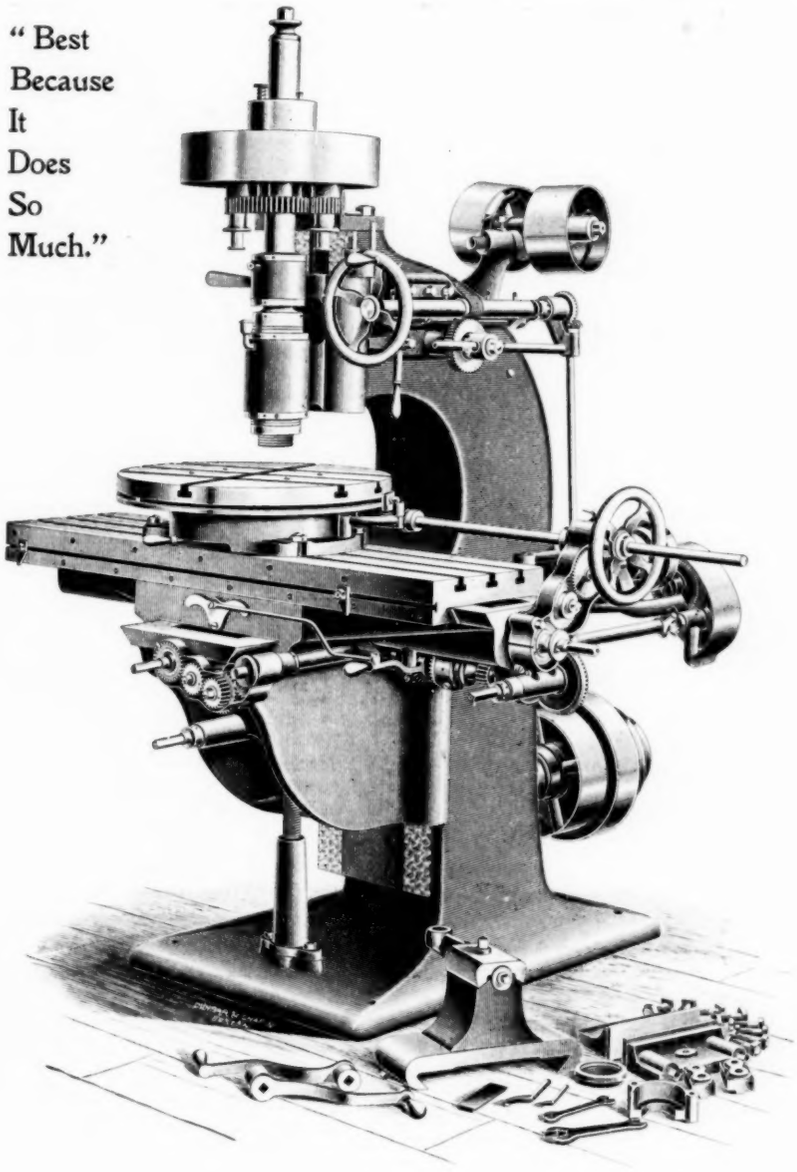

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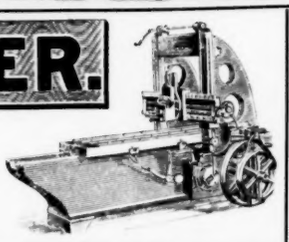

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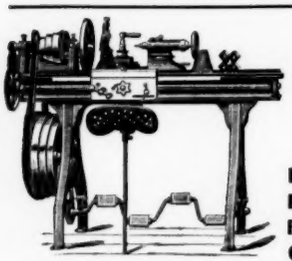

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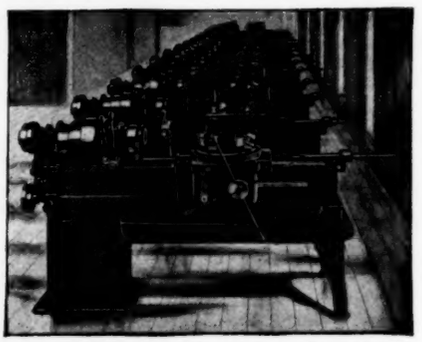

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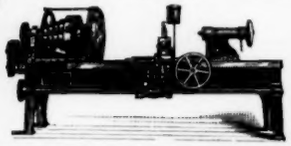

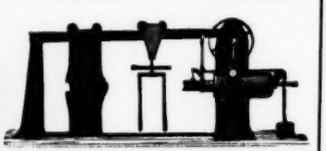

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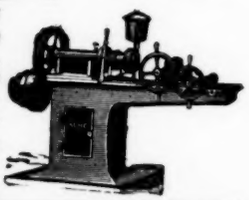

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